HANDBOOK OF ARCHITECTURE

Part II

ARCHITECTURAL STYLES

Volume 1

ROMAN ARCHITECTURE

By Josef Durm. Ph. D. D. Eng.

Privy Councillor and Professor at the Polytechnic School in Carlsruhe

Second Edition

STUTTGART

Translated by N. Clifford Ricker. D. Arch.

Professor of Architecture

UNIVERSITY OF ILLINOIS

Urbana. Ill.

1909

DIVISION I. ANCIENT ARCHITECTURE.

Section 3. Architecture of the Romans.

Preface to the Second Edition.

Twenty years have flown past since the first edition appeared. More than ten years ago steps were taken for a new edition; but the accumulating results of research and discoveries in the domain of classic art, the changed views resulting therefrom, and the rapid accession of materials prevented this. The latter must again be examined and be seen on the spot as far as possible. Journeys to Piedmont, to Friauli, Istria and Dalmatia, Syria and Palestine, southern France, middle and southern Italy, as well as to northern Africa, became necessary for this. The increased materials caused the contents of the volume to grow from 5 to 10 printed sheets for the "Architecture of the Etruscans" and from 18 to 39 sheets for the "Architecture of the Romans", the illustrative material increasing from 327 illustrations inserted in the text and 2 colored plates to 865 of the former and 3 colored plates. The original intention to give only illustrations from drawings made by the hand has been departed from, since it appeared best for many pieces of evidence to reproduce their actual condition as faithfully as possible, which could only be done by accepting the aid of photography.

The present volume is subdivided like the first edition, but it has become more definite in execution and richer in contents. Yet it presents nothing final. Art and Science know neither stagnation nor end.

Carlsruhe. Autumn of 1904.

Josef Durm. Ph. D. & D. Eng.

Part II. Division 1. Antique Architecture.
Section 3. ARCHITECTURE OF THE ROMANS.
By Dr. Eng. Josef Durm.

". . . . But the ancients generally troubled themselves little with the beauty of Rome, while they were busied with other greater and more necessary things; on the contrary, later generations, and especially our contemporaries, did not neglect this but filled the city with numerous and beautiful magnificent structures."

Strabo. Book V, 3, 9.

"Thou, O Romans, rule the nations of the earth sphere as supreme. Of such art be thine; then ordain laws and customs."

Virgil, Eneid VII, 852.

A. INTRODUCTION.
Chapter 1. Historical Survey.

Rome's earliest history is lost in the realm of the mythical. According to Varro, the city was founded on April 21 in 753 B.C. as an advanced post of Latium; the Palatine hill is given as the site of the founding; Latin herdsmen are mentioned as the first inhabitants, which intermingled with the crowding mountain people of the Sabines. There was already developed a municipality at an early epoch.

Romulus passes for the founder of the civic state, Numa Pompilius as the founder of the state religion of the Sabines, being a priest-king, to whom the deity transmitted his revelations.

The first form of government was the kingdom. Moreover, the entire history of the kings is not historically substantiated; it comes from a later time and is made artificial in certain respects.

The reference of the ancestors to Eneas and the Trojans has its basis in the general allied relationship to the Greco-Italian primitive race. Even the 5 th king, Tarquinius Priscus, is not historically established, and also the last, Tarquinius Superbus, is doubted, although to the former is ascribed the building of the Cloaca Maxima (Great Sewer) and of the Capitoline Temple(616 - 578 B.C). Servius Tullius (578 - 534), who reigned between the two, must have changed the earlier organization,

for to him is also attributed the fortifications of the city -- the so-called Servian Wall.

These rulers are designated by tradition as being of Etruscan race, which as the most competent and earlier civilized element had placed itself at a certain time at the head of the state. The expulsion of the last king may therefore be regarded as a national uprising of the Latins and as their first political act. The Romans had grown up under Etruscan rule and had become adult: the kingdom gave way to the republic.(510 B.C).

With the battle at Lake Regillus (496 B.C), the succeeding great Latin wars decided the independence of Rome. Two consuls with the senate, the former as executors and the latter as the highest council of state, composed the government; the priestly functions were entrusted to the rex sacrorum (king of sacred things), a personality without political importance, while the pontifex maximus (chief bridge-builder) presided over all religious affairs. Factional fights of the nobles and lesser wars strengthened and enlarged the young state. The internal disorders were restrained, when the common people (plebs) (457 B.C) secured a written law; the opposition of the claims of patricians and plebians was harmonized by a lawful basis.

The growing state seemed placed in jeopardy by the invasion of the Senonic Gauls, swarming over the apennines, when its legions were beaten before the gates of Rome (July 18, 390 B.C), and the city itself was burned. Thereby were also lost the historical archives, and therefore only henceforth do the historical materials become safer.

The aspiring city soon recovered from this stroke. After the Latin cities had also been conquered, military roads were laid out to ensure the supremacy (Via Appia, 312 B.C), with acqueducts for the benefit of the city.

By the successfully waged Etruscan war (311 - 208 B.C), the great victory of Q. Fabius over the Gauls and the victory of M. Curius Dentatus over Pyrrhus, king of Epirus, at Beneventum (272 B.C), all central and lower Italy were subjugated, and we see Rome emerge from these conflicts as a great power.

While previously most art works bore still an Etruscan character, they received a Grecian stamp from this time forth.

The first Punic war (264 - 250 B.C) shows to us Rome as ext-

externally strong and internally peaceful.

Its borders were extended by the annexation of Sicily: a dangerous enemy breaking in from the north, an army of 70,000 Gauls, was destroyed to the last man. For a second time was the state compelled to separate, when in the second Punic war, Hannibal almost destroyed the Roman military power.(218-216 B.C). The firmness of the people and of the senate overcame even this hard stroke, and a few years later the state had already so far recovered, that Spain could be made a Roman province; but the Punic army was beaten in its own country at Zama and was destroyed. The republican government appeared at its climax, the people were in their highest fame and heroic splendor.

The second Macedonian, Syrian, and the third Punic wars made Macedonia, Achaia and Africa Roman provinces.(200-144 B.C).

The Grecian war booty was brought home, the great number of Greek war captives were interned in Rome and Italy, they were in part skilled in arts, and they labored in their native style more faithfully, yet also in a decadence. The conditions of property were changed by the wars and conquest: the possession of the land passed into the hands of the nobles; the middle class was formed; slavery prevailed. agriculture was neglected, the small owner of land was ruined; life afterwards lost its simplicity and gave place to refinement and luxury. Nobles by birth and by purchase were united in plundering the state in the most selfish ways, while the proletariat increased and the freeborn and land-owning peasantry were pauperized. The endeavors of the Gracchi to heal these disorders, the strife for agrarian reforms, ended after a contest of 22 years in the victory of the nobility.

Seriously was Italy also injured as a result of the so-called war of the allies -- war became a trade!

The war between Marius and Sulla completed the Romanizing of Italy as a result, but it also laid a foundation for a military despotism (88-78 B.C). The republic could be maintained no longer.

In spite of these political affairs and internal strife, art and art industries flourished, which entered upon a mighty upward movement, even in this unquiet period. The noble families competed with each other in the erection of splendid buildings.

Temples arose; but buildings for investment and the doubtful artistic worth and small stability pressed into the foreground.

The most costly materials were employed therein, private dwellings with luxurious gardens were erected, some having a value of $250,000. "Buildings like the palaces of Persian kings", according to Strabo.(Book V,2)! With this mighty uplift of the monumental and minor arts coincided the climax of Roman literature. Julius Caesar began about this time to add to the Roman empire the countries on the North and Baltic Seas, conquered Helvetians, Germans and Belgians, and he extended his military campaigns to Britain.

From the civil wars proceeded Pompey as dictator, military commander, consul for 10 years, and half a deity! His grand nephew Octavian, who received the name of Augustus (27 B.C), entered on the rule of the Roman empire and people as the first perpetual emperor (imperator) and prince of the senate. The monarchical form of government put an end to the republican and that of a dictator, and it continued until the fall of the Roman empire.

Architecture was uncommonly favored by these changes in affairs, and especially by the reign of Augustus, he could proudly say, "that he had transformed the brick city of Rome into one of marble."[132] The most splendid works date from this period. "Pompey, Caesar, Augustus, their sons and friends, spouses and sister had surpassed the zeal and outlay of all others in reference to buildings." (Strabo, Book V,8,9). And the same contemporary author further tells us (born 66 B.C.; died 24 A.D); -- "Most of their (structures) were on the Field of Mars (Campus Martius), which in addition to its natural beauty added also the adornment of wise forethought."

Note 132. Marmoream se relinquere quam latericiam accepisset. --"Latericia" here means unburnt or air-dried and not burnt bricks.

"For the wonderful magnitude of the field, which affords unrestricted space at the same time for chariot races and riding exercises, in spite of such a great multitude of men, who exert themselves in playing ball, in driving hoops and in wrestling, then the surrounding buildings and the turf lawns, green during the entire year, finally the circle of hills beyond the river,

which present the view like an amphitheatre down to its bed, all this affords a scene, that is left with difficulty. Near this field is yet another, and around the same is a multitude of porticos, ornamental groves, three theatres, an amphitheatre, splendid temples adjoining each other, so that it must appear superfluous to even describe the rest of the city. Therefore the Romans, who consider this place as particularly sacred, have also placed there the monuments of the most famous men and women. But the most remarkable among them is the so-called Mausoleum, a great mound of earth beside the river, built on a high basement wall of white marble, thickly covered by evergreen trees, even to its apex. On its top stands a bronze statue of the emperor Augustus; but beneath the earthen mound are the tombs of himself, his relatives and his friends, behind it being a great grove containing the most charming walks. In the midst of the field appears the wall enclosing the place, where he was cremated, likewise of white marble, surrounded by an iron fence, inside which are set poplars. If one then goes into the old market-place and sees how beside it, one market-place adjoins another, with basilicas and temples, and one beholds the Capitol and the art works to be found both there, on the Palatine and in the walks of the Livia, everything lying outside is easily forgotten. Thus is Rome constituted."

"Nearly every house has its water tank, pipes, and abundantly flowing fountains, to which M. Agrippa devoted the greatest care, and who likewise adorned the city by many splendid works."

Religious art did not stand as the climax of the great movement in the architectural realm, as occurred in the best period in Greece, and the highest undertakings did not culminate in it.

"Thunderbolt, shield, trident ,etc. are mythical, together with the entire ancient theology, only for terrifying the minds of children," says the same Strabo.

The successors of Augustus kept equal pace with him in the erection of magnificent buildings, and the art feeling of the people at first rose to a like height. Tiberius, Caligula, Claudius, Nero, Vespasian, Titus, Domitian, Trajan, the art-loving Hadrian, the Antonines, Septimus Severus, Caracalla, Alexander Severus, in part splendid statesmen, commanders and rulers, for two centuries displayed wise practice of art, and they

left behind them marks of their activity in architecture throughout almost the entire world then known.

Under the rulers last named and their immediate successors, the Persians menaced Roman Mesopotamia and Syria; anarchical conditions made themselves felt in Rome; Germans passed over the Rhine, Goths and Scythians over the Danube; the soldiers in the provinces elevated their commanders as emperors. In this dangerous situation the soldierly Aurelian (222-275 A.D.) again saved the leaky and staggering ship of state from complete destruction; he protected the city (Rome) by the massive fortification walls named after him. He likewise knew how to direct his attention to architecture, when after his victory over Zenobia in Palmyra, he restored and improved the great Temple of the Sun, and also had a similar one erected in Rome. The last splendid pagan structures arose under Diocletian, "the father of the golden age," to which are added the Circus and the Basilica of Maxentius.

If the faith in the ancient gods was already shattered in the Augustan period, so was it given the death stroke by the rising Christianity. When Constantine raised Christianity to the state religion, paganism passed into a lingering decline; even two hundred years later, it prolonged a miserable existence.

The capital of the Roman empire was now transferred to Byzantium, more favorably situated between the eastern and western halves of the empire, and the ancient capital of the world, eternal Rome, appeared given over to ruin as its fate. On his visit in 357, Constantine was astonished by all the pagan grandeur, "the Temple of Jupiter on the Tarpeian Rock, which gleamed as if divine before the eyes of men, the Forum of Trajan, before the design of which he stood as if stupefied." (Compare Ammianus Marcellinus).

The works of this latest period frequently exhibit a doubtful caprice, even barbarism, especially strong exaggeration and a lack of clearness in detail forms resulting therefrom; yet most must be designated as important undertakings, especially in regard to construction.

The highest magnificence was succeeded by poverty and flatness; men did not hesitate to plunder and to destroy existing monuments of a good period, in order to decorate or erect new ones

th

therewith.

Not without regret is the famous Roman Arch of Constantine to be viewed, who sought to clothe its mostly rude forms of detail with better reliefs and accessories of the time of Trajan, an architectural gateway, by which we leave antique Roman architecture and enter upon the germinating Christian art, that was at first compelled to create its expression of form with the architectural fragments of ancient art; while it invented the new and great architectural ideas, that are deposited in the Christian Church.

Once more did paganism receive support under Julian the Apostate (361-363), while under Gratian was withdrawn the subsidy of the state to the worship; altar and statue of Victory, "the religious and political symbol of the grandeur of Rome," was removed from the Roman senate chamber; yet the temples remained; the private worship of deities was not disturbed.

Fabius Pasiphilus (394) entirely destroyed the reminiscences of paganism in Rome and other places, and Christianity completely mastered the Roman empire of the world. With Theodosious the Great vanished the last of the great ancient emperors. Under his sons Arcadius and Honorius, who separated in the empire, the West Goths broke in under Alaric and plundered Rome.

With these emperors, the architectural activity of Roman rulers reached its end; pagan buildings fell; they sunk into stone quarries for the later races; the plundering of the city for 14 days by the Vandals under the government of Maximus (455) completely exhausted the precious works of art. With Romulus Augustulus as the last Roman emperor ended (475) the western Roman empire. The ruins of the buildings of the great period remained in spite of all disasters experienced by them, and in spite of their being temporarily forgotten, they were no dead models for future races; bu their means was ripened that revival of the antique in Italy, which under great intellects, like Brunellesco, Alberti, Bramante, Raphael, Michelangelo, and others, was to develop splendidly and more magnificently, like the ancient art prostrate in the dust.

B.C.

TABLE OF THE HISTORY OF ARCHITECTURE.

753. Founding of Rome. Rectangular Rome.(Roma quadrata), earliest remains of the walls of Rome ? (E. Braun,1852).

753. Ruins of the Palatine Citadel ! (Jordan, 1878).
Contemporary or perhaps older. Walls with polygonal or horizontal courses in ancient Italian cities. (Praeneste, Ferentinum, Alatrium, Vesulae, Arpinum, Cora, Norba, Signia).

Between
616-578. Great Sewer (Cloaca Maxima) and the Temple Capitoline built under Tarquinius Priscus. (Also ascribed to Tarquinius Superbus).

Between
578-534. So-called Servian Wall is constructed.

493. Erection of Temple Ceres in Rome. (Tuscan Aerostyle building).
Before this time everything was Tuscan in the Roman temples. (Pliny, 35, 12, 45, 154).

390. Rome burned by the Gauls; only the Capitol remained uninjured. Rapid and irregular rebuilding of the city; the building material for this being chiefly tufa and peperino covered with stucco.

Between
362-344 Building of Temple of Juno Moneta on the Capitoline hill.

312. The censor Appius Claudius builds the first military road and aqueduct. (Via Appia and Aqua Appia).
Private architecture still poor.

311. Temple Salus on the Quirinal and Temple Concordia on the Capitol were built.

304. Fabius Pictor decorates the former with paintings. (Pliny, 35). Substructures of the Capitol. Ornamentation of the Forum.

Between
302-290 Increase of temples; the art works in them still Etruscan or taken from Grecian cities.

Between
295-283 Temples Jupiter Stator and of Esculapius on the island in the Tiber are erected.

264. The first combats of gladiators without any special structural preparation for holding them.

260. Columna rostrata, after the first Roman naval victory of Duilius.

254. Temples Janus and Spes on Forum Olitorium are built.

250. Sarcophagus of Scipio Barbatus (Consulate of Scipio, 298.).

212. Marcellus brings from conquered Syracuse Grecian art works to the Temple of Honor and Virtue on Porta Capena.

209. Fabius Maximus brings Grecian art works to Rome from conquered Tarentum.

208. Fire in Rome.

196. Flaminius brings to Rome marble and bronze statues from various cities of Greece.

196. Memorial Arches of L. Stertinicus erected on Forums Romanum and Boarium (Livy, 33, 27) for the ornamentation of the city.

192-174. Emilius builds the Emporium on the Tiber, Temple of Hercules and of Muses, an abattoir with selling rooms on the Caelian hill.

185. A permanent theatre is again torn down as a luxury.

184. Cato erects the first basilica on the Forum, improves fountains and sewers.

167. Temple Juno Sospita built; public buildings become richer; the art works carried out of Greece are exhibited in Rome; the dwellings are more richly treated there.

146. Mummius brings other Grecian art works from destroyed Corinth.

143. Metellus had the first marble temple, which included the Portico of Metellus on the Field of Mars, built by the Greek architect Hermodoros from Salamis. The same architect also executed the Temple of Mars at the Circus Flaminius.

The architects employed in Rome are mostly immigrant Greeks.

83-78. Temple Fortuna in Praeneste is splendidly restored by Sulla.

by Sulla. by Sulla.

New temples along the side of the Field of Mars.

The orator Crassus (died 91) built the first private house adorned by marble columns.

The House of Lepidus is ornamented with Numidian marble.

78. Lutatius Catulus builds the Tabularium near the Capitol.

Temple Fortuna Virilis built in Rome; building ma-

78 materials travertine and peperino mixed, with a coating of stucco.

Temple Vesta (Hercules ?) in Rome, of white marble with foundations of tufa and travertine. Thoroughly restored or rebuilt, well in the second half of the 1 st century A.D.

72. Temple Vesta (Hercules or Sibyl ?) in Tivoli.

Travertine columns, random ashlars with stucco. Fabrician Bridge. Temple Hercules in Cori.

Magnificent public and private buildings. Marble walls, mosaic floors, costly kinds of marble for columns.

60. Tomb of Cecilia Metella.

58. C. Curio places the two theatre auditoriums opposite each other in one wooden structure and admits gladiators to the circular room.

55. Pompey has the first stone theatre built with gardens and porticos.

44. The building of palaces increases; they may already be numbered by hundreds.

26. Septa Julia was begun by Caesar for centurial and tribute assemblies, dedicated by Agrippa.

25. Pantheon of Agrippa completed according to the plans of the architect Valerius of Ostia.

14. The books of Vitruvius appear.

13. Theatres of Balbus and of Marcellus.

3. Sublician Bridge rebuilt in stone.

0. Buildings of Augustus:-- Curia and Chalcidium, Tem-
A.D. Apollo, Temple Julius, Lupercal, Portico Octaviana, Pulvinare of the Circus, Temple Jupiter Feretrius and of Jupiter Tonans on the Capitol, Temple Quirinus on the Quirinal, Temples of Minerva, of Juno Regina, of Jupiter Libertas on the Aventine, Temple Lares and Penates on the Velian, Temples Juventus and of Magna Mater in the Palatium, restoration of the Capitol and of Theatre of Pompey, doubling of Aqua Martia, completion of Forum Julius with Temple Mars, Temple Apollo, and Theatre of Marcellus.

0-14. Temple Minerva in Assizi.

0-14. Temple Corinthian in Pozzuoli.(Puteoli).

Temple Augustus and Roma in Pola.

4. The so-called Maison Carree in Nimes.(Nemausus).

6. Tiberius rebuilds the Temple Dioscuri; the Arch of Dolabella is erected; Temple Saturn restored.

Luxury increases in palaces.(Compare descriptions of Horace.

Mausoleum of Augustus.

14-37. Statilius Taurus builds the first stone amphitheatre in Rome, although wooden ones were still erected beside it.(29 A.D).

Increasing interest in art. Restoration of Temple Dioscuri, Temple Concordia, Temple Ceres, Temple Liberi et Liberae. Arches of Tiberius, Pretorian Camp, and palaces at Capri are erected; palaces of Caligula on the Palatine; Capitol Bridge.

41-54. Burning of Rome under Nero.--- Rebuilding of the quarters within 4 years with solid materials, lower houses and wider streets. The quarters are regularly subdivided; the dwellings are more beautifully arranged and are adorned with decorative art works.

64. Golden House of Nero, extensive palaces, the Circus on the Vatican, the Aqueducts for the Coelian and the Palatine are planned.

70. Under Vespasian is built the Temple Peace in Forum of Peace, the Temple Capitoline is rebuilt, and the Colosseum is begun.

Erection of Baths of Titus.

79. Pompeii, Herculaneum and Stabiae destroyed.

Fire in Rome, which injured the Pantheon, the Baths of Agrippa, Temple Saepta, etc.

81. Arch of Titus built, which was voted in 70.

82. Colosseum or Flavian Amphitheatre completed. Similar works are executed in the other large cities of the Roman empire, in Reggio, Pompeii, Herculaneum, Albanum, Tusculum, Sutri, Pola, Verona, Nimes, Treves, Constantine, etc.

To 96. Under Domitian, the city is beautified in a more general way, and the temples burned under Titus are

To 96. rebuilt; streets are widened; the great Flavian imperial Palace is built on the Palatine; entrance and triumphal arches are erected, and Temple Vespasian is constructed; likewise the Forum Transitorium with Temple Minerva, Baths, Circus, Odeum, with military roads and bridges outside Rome.

113. Forum Trajan and Basilica Ulpia designed by Apollodorus from Damascus.

117. Memorial Column and Arch of Trajan, whose reliefs were again employed on the Arch of Constantine.

117-138. Temple Rome and Venus designed by Hadrian himself and erected in the most splendid manner. Bridge S. Angelo (Pons Aelius). Mausoleum of Hadrian (Castle S. Angelo); Villa of Hadrian near Tivoli; buildings in Nimes, Athens, Egypt, Syria (Hauran).

141. Temple Faustina on Forum in Rome. Pantheon of Hadrian.

150-200. Buildings in the Hauran; style not purely Roman, but modified by the people of the Hauran; the latter are immigrant southern Arabs.(Compare Wetzstein and Socin). Consistently constructed stone structures of granular dolomite. Stone houses, stone-beam ceilings and stone vaults, stone door and window leaves, stone house furniture, chests, tables, bedsteads, and candelabras are made.(De Vogue).

2 nd and 3 rd centuries.

150.? Bosra (Nova Trajana Bostra), frontier fortress and seat of the prefect of the legion, with city walls, gates, naumachia, triumphal arches, baths and temple.

Souideh with a Nymphaeum and Aqueduct of Nerva Trajanus Caesar.(103). Temple and Basilica.(4 th century). ?

151. Atil with Temple; whose Corinthian columns have supports for statues (consoles) as in Palmyra. According to an inscription, of the 4 th year of the reign of Antoninus Pius.(151 A.D).

Kennawat with Temple of Sun, Theatre and Hippodrome, city wall and towers.

Suleim (Neapolis) with magnificent Temple and Baths.

245. Schobba (Philippopolis) with city walls, temples, amphitheatre, baths, etc.

Musmiye (Phaenos) with Temple.

2 nd & 3rd centuries. Buildings east of Jordan; executed with limestone ashlars.

Gerash (Gerasa) with stately gate (era of Trajan ?), naumachia, theatre, forum, temple, rows of columns along street with square pylon, Temple of Sun.

Amman (Philadelphia) with Roman walls, theatre, odeum, baths and temple. The forms recall those on the buildings of Baalbec.

161. Memorial Column of Antoninus Pius.

180. Memorial Column of M. Aurelius, Equestrian Statue on the Capitol, Triumphal Arch, Temple M. Aurelius.

180-192. Baths of Commodus; fire destroys Forum of Peace, a part of the Palatine, and the great Library.

193-211 Palace on southern Palatine, Memorial Gate at Velabrum.

Arch of Janus Quadrifrons. Restoration of Pantheon.

203. Arch Septimus Severus. -- Septizonium.

211-217. Baths of Caracalla, marble plan of city, construction of Aqua Martia.

218-222. Elagabalus builds on the Palatine the Elagabalum and a Temple of the Sun in his gardens on the Esquiline.

222-235. Alexander Severus builds the Alexandrine Baths, erects buildings on the Palatine, constructs a Stadium on Circus Agonale, and builds Aqua Alexandrina.

237. Great fire in Rome.

238-248. Villa of Gordian III.(Now Tor de Schiavi).

260-268. So-called Temple Minerva Medica in Rome; Arch of Gallienus.

211-276. Great fortification of the city of Rome by walls. (Walls of Aurelian). Temple of Sun.

273. Restoration of Temple of Sun in Palmyra; Temple of Sun in Baalbec (Heliopolis); Tombs, Temples and Amphitheatre in Petra. The native oriental art here mingles with the Greco-Roman.

284-305. Baths of Diocletian in Rome (now S. Maria degli Angeli)

284-305. Restoration of the burned Basilica Julia, regulation of the Tiber, restoration of Theatre of Pompey. Palace of Diocletian in Spalato. Amphitheatre in Verona. (?).

305-324. Circus and Basilica of Maxentius, dedicated by Constantine, Baths of Constantine on the Quirinal.

312. Triumphal Arch of Constantine.

306-331. Buildings in Treves under Constantine.(Compare the eulogy of Eumenius in 310).

375-379. Theodosius the Great destroys the great "Trilithon" Temple in Baalbec (heliopolis) and transforms it into a Christian Church.

LIST OF ROMAN EMPERORS.

For the easier orientation of the reader, a list of the Western Roman emperors may follow with a statement of the years of their government, since reference to it must be frequently made later.

B.C.	Roman emperors.	193.	Septimus Severus.
44.	Julius Caesar murdered.	212.	Caracalla.
28.	Caesar Octavainus Augustus.		Geta.(died 212).
A.D.		217.	Macrinus.
14.	Tiberius.	218.	Elagabalus.
37.	Caligula.	222.	Alexander Severus.
41.	Claudius.	235.	Maximinus.
54.	Nero.	238.	Gordianus I and II.
68.	Galba.		Pupienus & Balbinus.
69.	Otho.	238.	Gordianus III.
	Vitellius.	244.	Philippus Arabs.
69.	Vespasianus.	249.	Decius.
79.	Titus.	251.	Gallus & Volusianus.
81.	Domitianus.	253.	Aemilianus Valerianus.
96.	Nerva.	260.	Gallienus.
98.	Trajanus.	268.	Claudius II.
117.	Hadrianus.	270.	Aurelianus.
138.	Antoninus Pius.	275.	Tacitus.
161.	Marcus Aurelius.	276.	Florianus.
180.	Commodus.		Probus.
193.	Pertinax.	282.	Carus.
	Didius Julianus.	283.	Carinus & Numerianus.

284. Diocletianus.
305. Constantius
Chlorus.
305. Maximianus.
Galerius.
306. Constantinus Magnus.
324-337. Sole ruler.
307. Maxentius.
Severus.
Licinius.
Maximinus II.
337. Constantine II.
Constantius II.
Constans.
360. Julianus.
363. Jovianus.
364. Valentinianus I & Valens.
Division of Empire.
367. Gratianus.
375. Valentinianus II.
379. Theodosius I.
392. Sole ruler.
383. Arcadius.
395. Honorius.
425. Valentinianus III.
445. Petronius Maximus.
455. Avitus.
– 457. Majoranus.
Severus.
Anthemius.
Olybrius.
Glycerius.
Julius.
Nepos.
475. Romulus Augustulus.
476. Fall of Western
Empire.

From 395, the year of Theodosius' death, the division of the empire was permanent.

The Eastern Roman emperors are not included in the Table.

Chapter 2. Characteristics of Roman Architecture.

116. Country and People.

In the midst of a narrow and fortunate land washed by three seas -- which is bordered and protected on the north by lofty masses of moontains covered by eternal snows, and whose southern point lies nearly midway between the Syrian coasts and the straits of Gibraltar, and which in consequence of this situation is equally suited for the starting point for undertakings of all kinds, whether directed toward south, east or west --- the city was founded by peasants and herdsmen, whose citizens were called upon to labor successfully on the highest problems, that ever fall to the human race, to prescribe laws to the world then known, or to impress the stamp of their own existence upon it.

The murder of a brother and mighty deeds of the most varied kinds attend the cradle of ancient Rome; a great part of the rudeness and savagery in the character of the founder of the state passed as a heritage to those born later, which sometimes were realized and utilized with more or less success. The unlimited trust in the protection of the gods, in good fortune, and in their own powers distinguished the adherents of the young state and impelled them to undertakings and aims, which, when once seen, were held and executed with iron persistence.

The consciousness of belonging to a great people, that commenced with nothing and had become everything, made the citizens of the matured state earnest and dignified. Characteristic was their self-praise for their deeds in war, in their statesmanship and politics, as well as their sternness, their love of conquest and rule, with which they indeed rightly absorbed their enemies.[133] "More mighty in war than mighty in wisdom," says of them the ancient poet Ennius.

Note 133. See statements of Jugurtha and of Antiochus.

117. Cultivation of Art.

What we term the Roman system is nothing more than a further development of what existed previous to the founding of the city. The predominating interest devoted to arrangements of the state and the establishment of its power left primarily very little remaining for the fostering of art. The practice

of the arts by foreign elements made serviceable in earlier and even in later times afforded small opportunity for any particular treatment. During the first centuries, Etruscan arts were compelled to satisfy the need of art works, until they were replaced by subjugated and immigrant Greeks. "You cannot lack men versed in building. There is no province, that does not have experienced and talented men; but do not believe that it might save time to send them from Rome, since as a rule, they come to us from Greece," Trajan writes to Pliny. (Epist. 49).

Grecian art already stood on the shoulders of oriental art, and we see originality absent from Roman art in a yet higher degree. We have to do here with compromises, combinations, and borrowings. The phenomena are similar in the beginning of Grecian and of Roman art. Both races, Greeks and Romans, were surrounded by an already more highly developed civilization. Phoenicians, Egyptians, and the peoples of central Asia had already progressed far, before it began to dawn in Greece; Etruscans were at an early period already settled on the north and south of the newly founded Roman state, had long cultivated the arts and sciences, and they at first ruled even in the principal city of the Romans. Even in the 12 th century B.C., the inhabitants of the islands and of the western coast of the Mediterranean were engaged in commerce with Egypt.

The ruder and more powerful elements utilized the more civilized and weaker, and these were compelled to labor for them, before the leadership in the work was assumed by the former. Thus it should not be forgotten, that in the ancient Hellenic free states, the laborers were slaves and foreigners, i.e., captives.[134] To have assumed and carried out such a leadership in the happiest way is the high merit of the Greeks; this was less the case for the Romans in the domain of art. The desired and attained rule over the world must at last destroy all individuality, just as Grecian art under the influence of Alexander's campaigns for conquest and of his generals, lost the perfection and purity acquired in the period of Pericles, and it again allied itself with Asiatic forms, from which it was derived in part, and which it had stripped off in the best period. "Greeks, Jews, Chaldeans, Egyptians, are all to be

found in Rome, but Romans no more. Citizens exist no longer in Rome; there are only the dregs of the nations."

Note 134. See Aristotle. Politics. III.3.

Likewise the later rulers, especially the most capable among them, were no longer native Romans; Spaniards or those descended from Spanish, Slavonic and Syrian races stood at the head of the world empire. A comparison of the character of the people and their style of architecture appears superfluous under these conditions.

118. Architectural Methods and Forms.

With the increasing sense of the people for beauty also, with their more vivid interest in art works, which showed itself toward the end of the republic, there yet remained in the governing class a certain disdain of Grecian abilities, which made itself apparent generally. (Compare the expressions of Cato, Cicero, etc.). But there cannot thus be denied to the Roman people the ability and understanding of art, which even sufficiently busied itself with the proposing and solving of entirely new problems. The permanent acceptance of the arch as an art form in its architecture, the magnificent development and ornamentation of arches and vaults ensure to them for all time a first place in the history of architecture as well. Even if the Etruscan had likewise already labored in this field, models for it may have been known to them from the period of Alexander or of the Diadochides (which have now vanished from earth); yet this does not lessen their merit.

But in addition to the arched and vaulted construction, the Egyptian-Grecian stone-beam construction occurs, and its combination with the former must be pleasing. With wide spacing of the columns, the arch of wide span replaced in many buildings the freely supported architrave, for which material of the necessary dimensions could not be obtained at all, or only at an immense cost, and together with the adjoining columns, it was compelled to descend to become a mere decoration, where they only had the purpose of animating the surface of the wall. The architraves were then composed of short pieces with radial joints, forming horizontal arches, or they extend deeply into the wall, crowning it and projecting moderately like a band. As soon as we do not consider the walls exclusively as enclosing

space, but also as supporting and bearing beams, then will this strongly cirticized Roman invention be judged much more mildly.

The external architecture of a monument also frequently exhibits the complete stone-beam construction, while recourse is had to arches and vaults in the members and covering of the interior. The variety of form and construction of the work is indeed thereby destroyed; but this lack of unity in construction is not exactly objectionable. Modern architecture would not be conceivable otherwise.

Piers and arches were separated, after the Etruscan model, (Volaterrae), by a special impost member; this separation is omitted on many Etruscan monuments (compare Perusia, Ferentinum), but it was raised to a rule by Roman architects.

At the connection of the columns with arches, during the best period the entire entablature with all its accessories is inserted between the two, which has given opportunity for harsh criticism, but this treatment is not without charm, in spite of its innate contradiction to the eye. The despised and so-called decadent period of Roman art is moreover found busied with the solution of this conflict. The semicircular curvature of the architrave and cornice above the two inner columns of a pediment facade, as occurred on the Temple in Atil (Hauran) and on the Palace of Diocletian in Spalato (Dalmatia), is a first beginning; the adjacent arcades on the monument last mentioned afford the complete solution, the direct resting of the arch on the column, which is otherwise accounted a merit of mediaeval art. Architraves of niches and gateways in Musmiye and Baalbec are also to be considered as precursors of the solution on the Palace of Diocletian.

The master at Baalbec likewise sought to replace the usual section of the archivolt, imitated from the architrave, by innovations, which do not belong with the worst experiments. In construction and particularly in stonecutting, the decided progress made in just that period are to be mentioned . The heaping of details and the unbounded love for ornamentation, that extends over all architectural members, are the weakest sides of the decaying Roman art. The entire completed series of Etruscan and Grecian architectural forms was adopted by Roman architecture, and only the ancient Doric style was laid

aside as unusable under the circumstances. Wide or narrow spacing of the columns with horizontal entablature depended, as everywhere and at all times, upon the resisting capacity of the material employed for them and on the form and dimensions of the chosen section.

For the combination of triglyphs and dentils on cornices, the Etruscan models were decisive (Norchia, Sarcophagus of Scipio Barbatus, etc.), and for these again the Sicilian-Grecian,(Terra cottas of Akrai), as already stated. The ornamental character of the triglyphs was retained in Roman stone architecture; a direct transfer of this architectural form from wooden construction may be assumed here, just as little as in Grecian-Doric architecture. The forms are not to be explained by a structural necessity.[135]

Note 135. Compare Chipiez, Ch. Histoire Critique des Origins et de la Formation des Ordres Grecs. Paris. 1876. p. 222.

Aside from the eccentricities and the misunderstood imitations of Grecian details, there is to be mentioned in respect to form and as an innovation, the richly treated modillions in the main cornice, with and without a combination with dentils, but especially the so-called Composite capital, with its overloading with Ionic and Corinthian forms of capitals, which became a favorite motive of Roman architects. Existing arrangements of small pilasters are indeed to be referred to Etruscan and Grecian models.

The same enjoyment of colors, which Egyptians, Greeks and Etruscans manifested on their buildings, passed into Roman art; only in time did the perishable polychromy applied with brush give place to a monumental one in stones of many colors. The introduction into architecture of variously colored marbles caused thereby is of importance. On a stylobate of light marble, for example, rose columns with polished white marble bases, above which were gleaming shafts of red or green porphyry, green banded cipolline, or reddish-gray granite, with capitals of white marbel or of gilded bronze, and on these the shining architrave, the frieze with golden inscriptions, and the roof with tiles of gilded bronze.

In technical respects, the architecture firmly adhered to Etruscan and Grecian traditions. In ashlar masonry are found

careful jointing of the stones, thoughtful arrangement, firm bonding connection of the separate stones chiefly by iron cramps and dowells, and the rejection of mortar in the use of larger ashlars, always remained the distinguishing characteristics until in the latest period. (Compare in Rome:-- the Colosseum, Temple of Antoninus and Faustina, the so-called Temple of Vesta or Hercules, Temple of Mars Ultor with the adjacent masonry; further, all known temples in Syria, Porta Nigra in Treves, etc.).

Construction with air-dried bricks was abandoned in the cities toward the end of the republic, burned brickwork being required in its place, and which was employed with complete mastery.

Undertakings like the Sedia del Diavolo or the so-called Temple of Deus Rediculus near Rome and at the Basilica of Treves remain for all time model works in common brickwork, not merely as concerning the technical perfection of the masonry, but of the treatment of the forms as well.

The city of Rome was in the earliest period simple and modest; the streets were without pavement, the market-place was surrounded by booths, the private houses being of wood and unburnt bricks covered by straw roofs. Stone construction was only in use for public buildings; for them were employed in the earliest period peperine from Albano, later Tiburtine travertine.

Until the time of the war with Pyrrhus, shingled roofs were still common, and even in 180 B.C., men jested at the Macedonian court about the poor city, not yet even forming a united whole. In 174 B.C., the streets in the interior of the city were paved, and only under Sulla did the private houses become splendid, so that the ancient temples looked simple and mean.

Besides ashlar and brick masonry, which always retained their supremacy for important buildings, there is also found the rubble masonry and concrete masonry with a facing of ashlars, small stones in courses, slabs or bricks.

To the cheapness of its production and the recognition of the value of lime mortar as a building material, the last named kinds of masonry owe their great and extensive use. Whether in these is to be recognized a specifically Roman method is un-

uncertain; it is more probable, that we have to do with one introduced from the East.

Besides massive construction and chiefly in buildings of utility and until the later period, half-timber work played a not unimportant part: a higher artistic treatment thereof, such as the later middle ages or the Renaissance cultivated, appears to have not existed.(At least the buildings with wooden bay windows in Pompeii exhibit merely the plain and necessary structural forms).

As the work of Roman architecture manifesting the greatest genius is the monumental covering of the internal rooms in the good style by means of stone vaults, which had as a result a complete revolutionizing thereof. The undertakings of the Egyptians and the Greeks in the same field relate to very moderate dimensions; more important are those of the Etruscans, although these still moved within narrow limits. What signify all the gate and bridge arches, the tomb vaults, or the vaulted passages and drains, which the peoples mentioned have left to us, -- even if we consider that 2500 years earlier, the principle was already known to the same races (vaults of the 6 th dynasty in Abydos, 2708 - 2510 B.C) -- compared to a single undertaking, the dome of the Pantheon! For a Grecian temple with a clear width of 32.8 to 36.1 ft. for the cell required two added rows of columns to support the ceiling, but we here see internal niches of 81.0 ft. clear span (Baths of Caracalla) with half domes, rectangular interiors of 78.8 to 82.0 ft. (Basilica of Maxentius) covered by tunnel and cross vaults, polygonal and circular rooms with domes up to 143.0 ft. span, in part remaining intact until our days, thus for more than 1800 years.

Possibly, and even more than probably, models already existed in Asia Minor for these great structures from the period of Alexander or of the Diadochides, [136] or also in north Africa, according to a statement of Caesar concerning Alexandria (Caesar De Bello Alexander. I. Nam incendio fere . . .). Yet we must pay to Roman genius the highest recognition, because it understood how to take possession of this oriental heritage and to bring it to the fullest development. Similarly great undertakings in vaulted construction can be shown only by Byzantine

art (S. Sophia) and that of the Renaissance (dome of Cathedral in Florence, S. Peter in Rome), both of which are based on the Roman.

Note 136. Compare Semper. Vol. 1. p. 477 - 479.

In spite of an advanced technical method and the more perfect building and architectural machines, the execution of structures like the Basilica of Maxentius or the Pantheon, whose intertior were to be covered and within which one could place the entire structure in three or five aisles of one of our mediaeval cathedrals, including buttresses and flying buttresses, would still have to seek for a man.

Likewise the well conceived and practical design of the transverse arches and ribs, which moreover generally disappeared beneath the usual ornamentation of the vaults, may be shown, as well as the use of buttresses. The resisting masses were indeed chiefly found in the combination of the plan of the building,[137]; but they likewise occur visibly as piers, as shown by the ruins of the upper portion of the Basilica of Maxentius, or as projections internally or externally, or on both sides, like the external walls of the peculiar vaulted basilicas of central Syria of the 1 st, 2 nd and 3 rd centuries.

Note 137. Compare Viollet-le-Duc, E. Dictionnaire Raisonnee de l'Architecture. Vol. 4. p. 284. Paris. 1875.

We first find here a consistent system of buttresses, that oppose the thrust of the vaults; they first form a kind of skeleton, where the side walls play the simple part of enclosures, an arrangement more perfectly repeated later in the French cathedrals.[138]

Note 138. Compare De Vogue. Introduction. p. 7.

For buttresses -- in a very general way -- models were found in Greece, for example, in the Cyclopean walls at Komboti in Akarnania,[139] in Etruria in the walls of Arretium, in Pergamon and in Athens.

Note 139. Compare Heuzy, L. Le Mont Olympe et Acarnania. Paris. 1860.

Of arch forms we find the horizontal and the triangular, the segmental, the semicircular and the pointed, the latter as a unique example at the Emissary of Lake Fucino (under the emperor Claudius); of vaults, the tunnel, the cross over both rect-

square and rectangular rooms, the niche or apsidal vault, and the dome over circular, square and polygonal plans: a fan-like vault with lunettes over a semicircular room is preserved in the Villa of Hadrian near Tivoli; a dome with intersecting compartments is shown by the great rotunda of the Baths of Caracalla, and the cloister vault by the Palace of Augustus on the Palatine.

The necessity for erecting domes over square rooms also enabled the Roman architects to invent the splendid pendentive,[140] and it is again in the Hauran, which exhibits the first one constructed of ashlars; then the valley of the Meander, which shows it built of bricks. The Sedia del Diavolo, the Minerva Medica and various polygonal buildings in and near Rome exhibit other perfected and attempted solutions in brickwork.

Note 140. Compare De Vogue.

According to the existence of the materials and the importance of the building or the means provided, the vaults were constructed of ashlars, of bricks, or of brick masonry ribs and concrete masonry. The internal surfaces were left smooth for the reception of plaster and painting, or they were paneled in simple or stepped square, oblong, lozenge, hexagonal or octagonal coffers.

For ashlar vaults, mortar was not employed, as a rule; on the other hand, iron cramps were used lavishly for bonding, or the separate stones were frequently joined together in a difficult way by a special jointing; in concrete vaults, iron only served for fixing the stucco ornaments. Covering the internal surfaces with metal plates (Pantheon ?) may be accounted rarities, while such must have been everywhere common, especially over domes.

The filling of the spandrels of the vaults to form flat terraces or in the form of gable roofs was also frequently covered by a tile roof; a wooden protecting roof over the vault was then regarded as superfluous. Either one or the other was employed.

For great structures, importance was placed on the use of the lightest possible materials (porous volcanic tufa).

The enclosure of pots in vaults may extend back to the end of the republic, it is systematically carried out in no really Ro-

Roman building for reducing the weight of the vault and lessening its thrust." The honor of the first consistent use of pots belongs to the architects of the Byzantine school."[141]

Note 141. Compare Choisy, A. L'Art de Batir chez les Romains. p. 96. Paris. 1873. -- Also by the same author:-- L'Art de Batir chez les Byzantines. p. 71. Paris. 1883.

The centre of intensity of architectural endeavor is not, as with the Greeks, to be sought in temple architecture, but in the lofty and extensive problems, that the expanded public and national life proposed to architecture. Basilicas, forums, amphitheatres, theatres, circuses and baths appeared therein; refined life and luxury required richer dwellings and villas, and the numerous Caesars demanded great palaces.

The care of the dead called for sepulchral designs with magnificent memorials; personal pride, self-deification, and later veneration created the memorial columns and triumphal arches. Paved streets, bridges, harbors, water-works, fortifications, etc., with aqueducts for use and ornamentation were the problems set for engineers in that period.

Just as far as the Romans bore their weapons did they likewise carry their art! On the border of the Syrian desert, in the rocky gorge of Petra, on the shore of the gulf of Baiae, on the beautiful coasts of Asia Minor, in rainless Egypt, on the slopes of the snowy Apennines and in the sunny valleys of Italy, on the Danube, the Rhine and the Moselle, on the heights of the Black Forest, in southern France or in adjacent Britain,-- we find everywhere the same architecture, or this with very slight limitations. The landscape background was sometimes formed by coniferous trees (pines, firs, larches, cedars and cypresses), sometimes of the luxuriant leafwood forests of the evergreen or common oaks, of beech es and chestnuts, sometimes of the southern palms, by wooded heights, bald rocky mountains with eternal snows, or by level shores washed by the sea-beat or the waves of an inland lake. No thought came to the world rulers, whether their structures also harmonized with the forests, or with the nature or climate of one or another region, upon which many modern experts in esthetics lay so much weight, and therefore might forbid the use of the "antique style" on this side of the Alps or even cause such conditions, entirely unknown to

[illegible], since the [illegible]

[illegible]

Most [illegible] the Italian [illegible] [illegible]. The [illegible] [illegible] a [illegible] of [illegible], [illegible] the [illegible] in [illegible] and [illegible] was [illegible], a [illegible] of [illegible] [illegible] is the [illegible]. The [illegible] of the [illegible] the [illegible] of [illegible] of [illegible], [illegible] the [illegible] of [illegible].

Note 115. [illegible]

[illegible]

The [illegible] the [illegible] on the [illegible] of [illegible] [illegible] [illegible] of [illegible] [illegible] [illegible]. The [illegible] of [illegible] of the [illegible].

[illegible] of the [illegible] the [illegible] [illegible] the [illegible] [illegible], [illegible] [illegible] [illegible], [illegible] [illegible] of [illegible].

and even inconceivable to a Roman, since the preliminary requirements were therefore lacking for him.

What characterizes the Italian landscape today for us was formerly not there at all. The opuntia cactus and the agave are a gift of America, just like the sycamore tree (platanus occidentalis) now planted in middle and upper Italy. The platanus orientalis was liked in antiquity, a native of Greece and the East, but it did not flourish in the northern provinces and suffered in the cold of winter. The oleander only came to Greece in the early period of the Roman republic and to Italy correspondingly later; the orange first came from the interior of Asia to Europe [142] after the era of Alexander, etc., and the Japanese eucalyptus now gives character to a portion of the Italian landscape.

Note 142. Compare Hehn, V. Culturpflanzen und Hausthiere. Berlin. 1874.

The architectural forms remain the same; the material in which they were executed might be anything; this had no influence on the art form but only on the method of technical construction. The Corinthian capital remained identical, whether executed in terra cotta, marble, sandstone or metal; only in the projections and in the treatment of the details is any attention paid to the peculiarities of the material. Material compels no style but only a particular method of construction; we can build in brick Gothic just as well as antique. The lack of certain building materials or the rich abundance of all kinds at a place effectively determined the development of the method of construction there.

Thus the peculiar course of the architecture of the Hauran is to be attributed to the fact, that stone was the sole building material, being a hard (dolerite ?) basalt, wrought with difficulty. consequently the arch was the principal structural element. By intelligent combinations of this with the straight stone beam, that could be obtained in lengths of even 16.4 ft., the inhabitants of the Hauran knew how to construct their temples, public and private buildings in this material. Walls, ceilings, stairways, doors and windows with their fastenings, wall-chests, furniture, candelabras, etc. were made of it; the roof was formed of stone beams covered by slabs -- in brief,

stone construction carried to an extreme.

Wealth and superfluity in means, combined with the endeavor for complete monumentality on the one hand, together with the lack of large timbers later on the other, led to metallic roof framework, an example of which over the vestibule of the Pantheon was still preserved some centuries since, and to the boxed-beams of Pompeii, made of trunks of trees.

Men sought to protect themselves against the climate in gany buildings by the method of technical execution. The uniform, flat, carefully joined tile roof was retained in both the south of Italy and the rude hills of the Black Forest or in the valleys of the Moselle, and only in the north were the snow loads opposed by stronger rafters, shorter and thicker tiles (1.48 ft. in Zehntland, 2.79 ft. or even more in the native country of Italy). And until this day, the northern steep roof, due to climate and conditions, and which was also known to the south in the earliest period, has never yet supplanted the flat antique shingle roof in the snowy mountain altitudes of Switzerland, Steiermark and Tyrol, or the flat stone slab roofs of the houses on the southern slopes of the Alps. But the tile roof and the tile manufacture have simplified the steep roof but have never improved it? Our tile roof over a layer of shingles is a rude attempt at the antique slab and cylindrical tile roof, and it lays less tight than that.

Thicker walls covered with hollow tiles must afford protection against cold and wet; hypocausts under the floors produced in winter a pleasant temperature in particular living rooms. (Compare imperial palaces in Treves, the colonies near Messkirch, Pforzheim, Baden, Sinsheim, etc.).

We everywhere behold the people faithful to its mission and treating in politics, as in art and practice, -- everything grandly and practically, carrying it out firmly and thoroughly!

B. [illegible]

[illegible] and their [illegible]ession.

"What kinds of building materials are to be employed is not [illegible] of the [illegible], because all kinds of [illegible] are not [illegible], everywhere." ([illegible]. Book II, [illegible].

[illegible] of building [illegible].

[illegible] the earliest ages and in all [illegible]. [illegible] have [illegible] been employed for building purposes [illegible] and at [illegible], which [illegible] for the [illegible]. [illegible] were [illegible] for [illegible], [illegible]. [illegible] with the arrangements [illegible] of the [illegible] these were [illegible], [illegible] advances and [illegible]. Improved [illegible] and [illegible] use of [illegible] in [illegible] and [illegible]. [illegible] that [illegible], [illegible] were [illegible] in [illegible], even if they were [illegible] from a [illegible]. [illegible] of [illegible] in [illegible] to [illegible]. [illegible] of building [illegible] a [illegible] and [illegible] which [illegible], [illegible] and [illegible].

[illegible] in a [illegible] country, [illegible] in [illegible].

[illegible]. [illegible] Stone.

[illegible] and [illegible]. [illegible] ([illegible]).

[illegible] in large blocks, [illegible] load [illegible] located, [illegible] and [illegible] ([illegible]), [illegible] building, always in [illegible]. [illegible] effective [illegible]-

B. CONSTRUCTION.

Chapter 3. Building Materials and their Preparation.

"What kinds of building materials are to be employed is not at the choice of the architect, because all kinds of building materials are not produced everywhere." (Vitruvius. Book VI. 8).

119. Choice of Building Materials.

In the earliest ages and in all settlements, there have certainly been employed for building purposes chiefly and at first those materials, which were to be had in the immediate vicinity, and such places were also selected for settlement, where usable building materials were to be found near fertile soil. Commerce and war with peoples advanced in civilization made them acquainted with the arrangements and the products of the country. If these were superior to their own, their adoption and introduction followed. Increasing wealth and luxury would then cause the use of those most esteemed in reference to goodness and costliness. But it is then self-evident, that the former materials were also still retained for building in later times, even if they were inferior to those brought from a distance, and that the inferior appear beside the superior, as is still the case. The construction depends upon the money, and not everyone that builds is in condition to be able to make use of the very best. Attempts to determine the ages of buildings on the basis of the earlier or later use of a building material at a locality can scarcely yield admissible results, according to what has been said.

Likewise in a conquered country, the native material is made useful before advancing in reference to the foreign.

120. Natural Stones.

For natural stones, Vitruvius distinguishes between soft, those of medium resistance, and hard. Most are obtained from open quarries, "much from underground." (Comare Pliny. Natural History. Book. 36).

all the softer stones broke out in large blocks, were easily wrought, supported any load in protected locations, while they weathered in the open air and were also attacked by sea water. According to Vitruvius (Book II, 6), they should be quarried two years before their use in building, always in summer, then being piled in sheltered places. Those becoming defective wi-

[illegible] as open in [illegible] ground for [illegible]ing above ground. This rule applies [illegible] to [illegible] people.

[illegible] the [illegible]-rooms [illegible] on [illegible] from the vicinity of [illegible], and also the [illegible] of a [illegible]. In [illegible] were [illegible] the [illegible], a white [illegible] in [illegible] like wool [illegible]."

[illegible] and even [illegible] more, [illegible] of [illegible] of the [illegible] of [illegible] the [illegible] [illegible] some [illegible]

[illegible]," in [illegible] 10 [illegible] Roma, [illegible] of [illegible] more [illegible]

[illegible] was used [illegible], often a [illegible] as [illegible] small [illegible] and more [illegible] of [illegible] more [illegible] [illegible]) [illegible] in the [illegible] that [illegible] of the [illegible]. [illegible] says of [illegible] and [illegible] other [illegible]

The [illegible] of [illegible] of [illegible] in [illegible], as well as [illegible], [illegible] of the [illegible], the [illegible] stones, [illegible], in [illegible] being [illegible]

within that time could still be used in foundations; those uninjured served for building above ground. This rule applied both to ashlars and to ordinary rubble.

With the soft stones were counted the reddish-brown tufa on the Flaminian Way or from the vicinity of Cervaretta, likewise the stone from Fidena and Gabia, and also the Alban stone of a grayish-green color (peperino). In Campania were mentioned the red and the black tufa, a white tufa in Umbria, Picenum and Venetia, "which could be cut like wood with a toothed saw." (Vitruvius. Book. II. 7).

By Pliny (Book 36; 44) is mentioned a white stone in the Belgian province, which was cut even more easily than wood, and served as a covering material for the so-called "peacock-train roof," instead of flat and cylindrical tiles. Doubtless the coarse limestone of the basin of northern France, still worked and used in the same way.

The Gabia stone, "which is also named red," is termed by Strabo (Book V. 3, 10) as that most useful for Rome, since most of the monuments of that city were executed in it.

In Pompeii was used a blackish-gray tufa, often shading into greenish, as ashlars, for pavements, or for small blocks in die-work, and for some purposes also a soft yellowish stone with many inserted pebbles, which quarried soft and hardened in time, yet weathered easily.

Of medium hardness is the Tiburtine stone (travertine), a white limestone varying to yellowish-gray, which is still used for Roman buildings, and whose ancient and modern quarries lie near together on the Tiburtine Way. (Building material of the Colosseum). The durability for nearly 2000 years in the most different structures best speaks for the good qualities of this material. Vitruvius says of it, that it supports any load, defies the weather, but is not fireproof, -- just as little as any other limestone.

The stone of Antemninae and of Mt. Soracte is likewise to be included here, as well as the Sarno limestone, which is used for the lower parts of the city walls of Pompeii, for example. To the Anicine stones, in color like the Alban, in the region of Tarquinii, whose best quarries were found on Lake Vulsine and in the prefecture of Statania, were attributed the best

[illegible] flowered in the first year [illegible]. [illegible]
[illegible] of food to be [illegible]
[illegible] conducted [illegible].

[illegible], the [illegible] and [illegible]
[illegible], were [illegible] for [illegible]. [illegible]
[illegible] Vergil [illegible] -
[illegible], [illegible] movements in [illegible] and [illegible]
[illegible]
[illegible] the [illegible]
[illegible] Vat. V. [illegible].

[illegible] in [illegible]
[illegible] on account of the [illegible]
[illegible] to the [illegible]
[illegible], such as -- [illegible], Hyacinth and [illegible]-
[illegible] the most [illegible]
[illegible].

[illegible], the enumeration of [illegible], N.
[illegible] 1918 [illegible]

[illegible], [illegible] to play the [illegible] of the pro-
[illegible], [illegible] in a [illegible]
[illegible].
[illegible], that [illegible]
[illegible], and [illegible]
[illegible] (Pliny, Hist. XXI, 1).
[illegible]
[illegible] "What [illegible] senses [illegible]
[illegible] individual, [illegible]
[illegible]."

The other [illegible] of [illegible], [illegible]
[illegible], of the [illegible] and [illegible], as
[illegible] yellow [illegible] (Lilium [illegible]),
[illegible], the [illegible] and aconite, [illegible]
[illegible].

[illegible], and [illegible]
[illegible] of grasses and
[illegible] the [illegible],
[illegible]. The [illegible] of the
[illegible]

qualities: "neither age nor fire could harm them." Vitruvius wished all buildings of Rome to be built of them. The buildings of Ferentum were constructed therewith.

All Liguria, but especially Pisa and Luna and particularly the latter, were famous for limestone quarries. They supplied both white and blue veined material in large blocks and so abundantly,"that the most famous monuments in Rome and other cities were built of it." "The stone was conveniently quarried, since the quarry lay near the sea and the Tiber received the traffic from the sea."(Strabo. Book. V. 2,15).

Besides this crystalline limestone of uniform color in the country, which was first exported on account of its strength and not for its splendor, there were likewise in use Grecian kinds of uniform color, such as:-- Pentelic, Hymettic and Parian; later were used all colored and variegated kinds of marble, and the imperial period accomplished the most surprising luxury with them.[143]

Note 143. Compare the enumeration of such in Gottgetreu, R. Die Antike Marmorarten. Zeits. f. Bauw. 1883. p. 103-132.

Pliny, who sometimes liked to play the Roman of the primitive type, blames the use of such costly materials in a rather too vulgar way:-- "That mortals can put this to no other use, or rather permit it for any other pleasure, than to lie between spotted stones, and yet the darkness of the night takes away this enjoyment during the half of life." (Pliny. Book 31, 1). He further complains, that men were silent, when Scaurus placed marble columns in his house; "when such great masses should be dragged into the dwelling of an individual, opposite the clay crestings of the temple of the gods." (Book. 36, 2).

Of black sorts of marble, the Lucullan and Lydian were much esteemed, of the yellow were the Numidian and cappadocian, as well as the onyx or yellow fired alabaster (lime-alabaster), of green, the Thessalian and Laconian, of variegated, the Carystic (cipolline), Jasic and Theban.

Columns, beams, and ashlars for walls could be procured of great dimensions in these materials. The art of grinding and polishing first gave the variegated marbles the charm, which eventually made them so much sought for. The durability of the material depended upon the careful treatment of the surface.

The division of the stone by saws and sand was known; according to Pliny (Book 36, 6), sawing into thin slabs was invented in Carya (351 B.C); Ethiopean sand was recommended by him as best for sawing.

The covering of thin slabs of marble over masonry was much practised in Rome for economical reasons, first on the House of Mamurra, an official of Julius Caesar. Thresholds of Numidian marble in blocks were caused to be set in his House by Lepidus (78 B.C).

The beauty of the surface of the stone in the open air is not of long duration in even the milder southern climate; polishing is of proportionally brief existence, since colored and variegated kinds of marble soon grow dim, those not of homogeneous composition rapidly weathering on the surface, and they are resistant to only a slight degree. The light homogeneous, whitish-yellow, light gray or pure white kinds deserve preference for use in the open air, the colored and variegated are better in the interiors of buildings.

Green and red porphyry and serpentine were employed with a like appreciation as the variegated marble.

The sandstones of Tuscany, whose use was introduced in Etruscan buildings (compare Art. 23), and which the Romans likewise used (compare Theatre and Cycolpean masonry near Faesulae), are scarcely mentioned by the ancient writers.

As hard building stones are to be mentioned basalt, lava and granite. Jambs of doorways, lintels, columns, capitals, tombstones, paving blocks, and millstones were made of the first, from the latter being obtained the splendid monolithic shafts of columns, which by the method of working and their colossal dimensions astonish us.(Compare the columns of the portico of the Pantheon and the so-called column of Pompey near Alexandria, the latter being 67.2 ft. high and with a lower diameter of 8.9 ft).

As a light material, which was only employed for very irregular rubble masonry and concrete vaults, are to be mentioned cruma, a coarse and porous light lava scoria of dark reddish=brown color, and pumice stone.

A stone much prized for its transparency was mica (lapis specularis), selenite, or Mary's glass. Split in thin sheets, it

was used for closing openings, where the wind was to be kept out and access afforded to the sunlight. Its resistance to heat and cold was well known.

A white stone with transparent yellow veins -- phengites -- (light-stone) --, also hard as marble, was quarried in Cappadocia in Nero's time. The Temple of Fortuna, who was termed the seed goddess, was built of it, and therefore "the interior of the temple was light as day with the doors closed." (Pliny, Book 36, 46).

In spite of the rich abundance of natural building material in the country, the entire world ruled by the Romans was compelled to place its useful products at the command of Rome, which did not fail to make extensive use thereof, even if the difficulties in obtaining them proved so great. Greece, Spain, Egypt, and Asia Minor had to open their quarries for the needs of the capital of the world.

121. Stone Cutting.

The dressing of the cut stone occurred soon after the quarrying (prying loose with iron tools or breaking off with wedges of iron and wood) by the aid of points and variously shaped chisels, such as are in use by stonecutters to this day. They are comprised in the following items:--

1. Wooden hammers (sledges).
2. Heavier iron hammers.
3. Handled points and double points, tooth axes, pickaxes.

All furnished with longer or shorter wooden handles.

The tools mentioned under 3 were employed for pointing or surfacing of stones and were of small or large size, according to the coarser or finer work, that was to be produced with them, and also according to the hardness of the kind of stone.

4. Chisels, wedges, points or pointed chisels.
5. Scraping tools of various forms and sizes.

The most common stonecutter's work was executed with these in pointing, cutting bosses, scraping, drafting angles and edges.

For finer ornamental and figure work were added the tooth chisel and the drill.

For rubbing and polishing the surface of the stone were employed blocks of harder stone of varied grain. But these methods

only become necessary, when men left tufas and stratified stones and passed to the harder kinds of stone, crystalline limestone and granites -- methods long common with the Egyptians and Phoenicians.

Generally, one cannot rely upon the various modes of dressing the stones for determining the age of buildings; these depend far more upon the peculiarities of the material and not on time and fashion; peperine requires a different treatment from travertine, and this again different from that of crystalline limestone, marble, and granite. Likewise in the late imperial period, a peperine ashlar was not treated differently than in the period of the republic.

122. Making Joints tight.

The filling of the joints of the ashlars with loam, lime, or mortar was only necessary where ashlar masonry was to be constructed with the so-called open joints, thus particularly in foundation masonry, where mortar was employed as the binding material.

The pointing of the joints in ashlar courses set without mortar would have little reason and also was not in use. The bed and end joints were wrought as fine as possible, frequently so that they are scarcely visible to the eye, equally so whether the faces of the ashlars were to receive plastering, a facing of slabs, or were to remain uncovered. The ashlar masonry in porous tufa of the temples of Sicily and southern Italy exhibit the finest jointing, although it was covered by stucco. Wonderfully jointed are the ashlars on the amphitheatres in Nimes and Arles, on the so-called Bath of Diana (Bagno di Diana) in Nimes, in the lower stories of the Colosseum in Rome , and in other places.

123. Bonding of Ashlars.

The buildings of the same period in Asia Minor everywhere exhibit the sunk beds, cramps and dowells, as well as a harmonious alternation of the joints, as regular as possible, that was also employed in Etruscan and Roman ashlar masonry, in the time of the republic, and in the early and late imperial period. The sunken beds (the sinking of the adjacent surfaces behind the enclosing borders), according to the evidence of Dalbrück, already occurs in the 5 th century on the podium of the

Temple of Apollo near Circus Flaminius, and then on the ashlars of the Oscan walls of Pompeii. Cramps are in the ashlar masonry of the Temple Fortuna in Rome; wooden dovetail dowells are in the ashlars of the Tabularium (87 B.C), likewise in those of the so-called Heidenmauer (Pagans' Wall) on the Odilienberg in Alsace, and in various other structures of the Roman Forum. (Steps of the Temple of Castor, a circular building near Basilica Julia). Dowells and cramps are found in columns and piers from the earliest to the latest period. Regular arrangement of joints was already known to Etruscan architects; it was executed with tolerable certainty on the walls of Caere and the Servian walls with the importance of a fully expressed bonding, and in a beautiful manner on the ashlar masonry of the Forum of Augustus at Rome. On later works it is a matter of course. (Tombof Cecilia Metella, the so-called Temple of Vesta, Temple Fortuna at Rome, etc.).

124. Ashlar Voussoirs and Horizontal Arches.

For the use and setting of voussoirs without mortar in semicircular arches and vaults, we have cited the evidence of the Etruscans.(Gates of Perugia, Tombs and Bridges in Etruria). As a substitute for long covering ashlars, where strong material in large dimensions was not to be obtained, men had recourse to straight arches, by means of which the purpose was attained by small dressed stones. Natives of Asia Minor and Etruscans indeed brought this into the country.(Compare Tabularium, Temple Fortuna, buildings in Pompeii, Villa Hadrian near Tivoli, substructure of Colosseum, Theatre in Ferenti, and others).

125. Air-dried Bricks.

Besides natural stones, there also occurred in Roman architecture the use of bricks for building purposes. The Semitic races, Babylonians, Phoenicians, Egyptians, and the Greeks were early acquainted with this simplest and oldest branch of the ceramic industry, it was in use by the Romans from antiquity. Not as burned bricks, but as air-dried bricks, i.e., dried in the sun, were they employed in the earliest period.

TABLE OF DIMENSIONS OF ROMAN BRICKS.

The Roman foot = 0.972 ft.= 11 2/3 ins, and it was divided into 16 inches.

TABLE OF DIMENSIONS OF ROMAN BRICKS.

Kind of Bricks.	Locality.	Dimensions.
Bricks for walls.	Rome.	8.65 × 5.5 × 1.18 ins.
,, ,, ,,	,,	9.05 × 5.5 × 1.18 ins.
,, ,, ,,	,,	9.45 × 5.5 × 1.18 - 1.57.
,, ,, ,,	,,	9.83 × 5.5 × 1.57 ins.
,, ,, ,,	,,	11.4 × 5.5-6.3 × 1.57
,, ,, ,,	,,	13.4 × 13.4 × 1.57 ins.
,, ,, ,,	,,	23.2 × 23.2 × 1.57 ins.
,, ,, ,,	,,	23.6 × 23.6 × 1.57 ins.
According to Pliny (Book 35,46)	Tivoli.	16.5 × 16.5 × 1.18 ins.
and Vitruvius (Book II,3), the	Ferenti.	23.2 × 5.9 × 1.18 ins.
"Lydian" brick was most common;	,,	23.2 × 23.2 × 1.18
it was about 17.3 × 11.4 ins.	,,	10.6 × 5.9 × 1.18 ins.
The "tetradoric" brick was 11.6	Treves.	21.2 × 21.2 × 2.36
ins., the "pentadoric" was 14.5	,,	21.6 × 21.6 × 2.36
ins long and wide.	,,	22.0 × 22.0 × 2.36
(Doron = the flat hand = 4 fingers	,,	23.6 × 23.6 × 2.36
wide == 1/4 Roman foot = 2.9 ins).		or 2.16
	,,	20.8 × 11.0 × ?
	,,	21.2 × 11.4 × 1.57-1.77
	,,	13.4 × 13.8 × ?
Palladio recommends the (bipedal)	,,	21.6 × 21.6 × 1.96-2.75
two-foot brick, 19.2 ins. square	Augst.	14.2 × 14.2 × 1.57
and 2.42 ins thick.	Mannheim.	14.2 × 14.2 × 1.57
Of floor tiles are mentioned	,,	15.3 × 12.2 × 1.38
the square tesserae and the	Neuenheim.	8.7 × 8.7 × 1.96
oblong spicae.	Badenweiler.	15.0 or 15.4 × 12.6 × 1.57
	Mentz.	11.0 × 11.0 × 1.18
	Hüfingen.	11.0 × 11.0 × 1.18
	Messkirch.	18.1 × 18.1 × 1.96
	,,	11.8 × 11.8 × 1.96
	,,	18.1 × 7.9 × 1.96
	Baden.	18.8 × 18.8 × 2.36
	,,	10.6 × 10.6 × 2.36
Hypocaust bricks.	Messkirch.	7.9 × 7.9 × 1.96
	,,	9.1 × 9.1 × 1.96
Spicae.	Rome.	3.9 × 2.3 × 0.79
	Mentz.	5.1 × 3.1 × 1.18

Hypocaust bricks.	Hüfingen.	6.7 × 4.7 × 1.57 ins.
Round bricks.	Mannheim.	8.3 diam. × 1.97 thick.
	,,	9.8 ,, × 1.96 ,,
	,,	7.9 ,, × 3.54 ,,
Triangular bricks.	Rome.	8.3 × 4.3 × 1.18 ins.
	Treves.	10.6 × 9.4 × 1.57 ins.
	Taormina.	17.6 × 7.9 × 3.94 ins.
Arched bricks.	Mentz.	13.8 top × 7.9 × 3.14 10.2 bottom.

Other dimensions of Roman bricks.

Palace Imperial.	Treves.	14.2 × 14.2 × 1.61-1.96 Mortar joint = 1.57 ins.
Palace Imperial.	Treves.	14.2 × 14.2 × 1.62-1.97
Floor tiles in Museum.	Treves.	20.0 × 23.1 × 1.77 ins.
Court of Baths, Barbara.	Treves.	22.0 × 22.0 × ?
Triangular bricks, Museum.	Saalburg.	16.9 × 5.1 × 2.75 ins. to 5.9 and 1.57
hexagonal tiles in Museum.	Wiesbaden.	15.5 × 15.5 × 2.36 ins.
(Triangular) Reservoir.	Ars sur Moselle.	a b 11.8 × 8.5 × 1.77 Mortar joint = 0.59,0.79,1.18
Baths Caracalla.	Rome.	22.4-24.8 × ? × 1.18-1.38 Mortar joint = 1.38-1.57
Near Frigidarium.	Rome.	11.0 × ? × 1.18-1.38 Mortar joint = 0.79 ins.
Palace Imperial.	Rome.	7.5 × ? × 1.18 ins. Mortar joint = 0.98 ins.
Gate Pretoria.	Turin.	9.4 × ? × ?
,, ,,	,,	15.4 × ? × 2.75 ins.
,, ,,	,,	18.9 × ? ?
,, ,,	,,	27.5 × 11.4 × ?

Mortar joints very close and fine, edge polished.

Tapered bricks. Turin. Width of normal bricks.

Tombs on Appian Way.	Rome.	9.4 × ? × 1.18 ins.
,, ,, ,, ,,	,,	9.8 × ? × ?
,, ,, ,, ,,	,,	11.8 × ? × ? Mortar joints = 1.18-1.97
Pantheon.	Rome.	11.0 × ? × ?
,,	,,	11.4 × ? × 1.38-1.57

Pantheon.	Rome.	11.8 × ? × ?
,,	,,	12.2 × ? × ?
,,	,,	13.4 × ? × ?
		Mortar joint = 0.39 ins.
Palace Diocletian.	Spalato.	Mortar joint more than brick.
In Museum.	Brescia.	11.8 × 17.3 × 1.96
,, ,,	,,	? × 16.9 × ?
,, ,,	,,	? × 17.1 × ?

Bipedal bricks are proved by stamps:--

a. On Pantheon. See text.

b. In Museum, Catania. See text.

Altrip near Mannheik. 17.3 × 10.2 × 3.53 ins.

Vitruvius (Book II, 3) and Pliny (Book 35, 46) require for the crude bricks, that they be free from gravel and sand; the stones are to be screendo out of chalky and whitish earth or of adamic earth (firm, loamy soil). Spring and autumn are considered the most suitable times for manufacture. Before use, they must generally lie for two years' a law in Utica even required five years' storage.

Building with these bricks may have continued for a long time in the country, as well as their use for internal construction in cities. According to Vitruvius, they were no longer employed in the city of Rome in the period of Augustus' they do not exist in Pompeii. The statements, that city walls were erected with them in a rainy climate, appear only to be believed, if a covering layer be assumed over the nucleus of the wall composed of air-dried bricks, for example, a coating with asphalt, or a facing with natural stones or hard bricks.

The ancient"walls of air-dried bricks" of Arretium so frequently mentioned prove to be in reality massive walls of quarried stones. (Compare Art. 25).

The air-dried brick was called "later" (plinthos) and was made by mixing chopped straw with the earth, carefully cleared of foreign substances and moistened, the mixture then being moulded into bricks by hand or ewen in special forms, which were then dried by turning in the sun.

126. Burned Bricks.

Burned bricks were designated by "laterculus", or"later coctus, coctilis, testaceus." They were important in all Roman

building construction and dominated in structural respects the architecture of Rome in the 2 nd, 3 rd and 4 th centuries A.D.

Note 144. Compare Nissen, H. Pompejanische Studien zur Städtekunde des Alterthums. Leipzig. 1877. p. 24.

In Pompeii, they first appeared in some towers of the city wall, then on the buildings of the Colony of Sulla and to a greater extent in the rebuilding of the year 63 A. D. In Greece, the earliest use of burned wall bricks must be referred to the era of the Diadochides or even later.

The accuracy of the statement of Pausanias concerning the Philippsion in Olympia, according to which that is to be considered "as the first definitely dated brick building on European soil, is doubtful.[145]

Note 145. Compare Blümner, H. Technologie und Terminologie der Gewerbe und Künste bei den Griechen und Römern. Vol. 2. p. 11, note 4. Leipzig. 1884.

Bricks were employed for masonry in square, rectangular and triangular forms in the most varied dimensions and thickness. The lengths measure from 7.8 to 23.5 ins.: the thickness varies from 0.79 to 3.94 ins. Special forms of bricks were made for hypocausts or cisterns, 3.14 and 3.53 ins. thick.

The preceding tabular collection of the dimensions of Roman bricks (p. 51) taken from different places gives a survey of the dimensions of the bricks employed for masonry in various localities.

The structures in Italy show, that the bipedal bricks recommended by Palladio were more used than those described by Vitruvius. They are also identified by stamps, as in the final clause of the Table. The use of triangular bricks, whose hypothenuse was set in the visible face, shows us the economy in the use of material.

The bed surfaces of the wall bricks and facing tiles, especially those of large size, was grooved in various ways, to produce better adhesion of the mortar (Fig. 193) to the surface.

127. Floor Tiles.

Among floor tiles, we find polygonal forms in addition to rectangular and square. (Compare Table, p. 51). The contact edges are then frequently made "under the angle" (relieved) in order to make a fine joint possible, and the under surfaces are

grooved like the beds of the wall bricks and for the reason already mentioned. The spicae (tesserae ?) were made of particularly small dimensions.

128. Round, Knob and Hook Tiles.

Round tiles (in the form of our "pan-cakes" ?) were employed either only in the pillars of hypocausts or in the construction of brick columns, as the inner nucleus.

In baths and living rooms occur square tiles 18.1 or 21.2 ins. on a side or rectangular tiles (20.0 × 7.9 ins.) with 4 projections -- tegulae hammatae -- at the corners and the so-called knob tiles, the tegulae mammatae of Vitruvius (Book. VII, 4). The projections or knobs were about 2.75 ins. long, only in part extending into the wall, so as to produce a space measuring an inch or so, through which the warm air could pass, or it was intended to keep the moisture out of the room, which was driven through the wall. At the Stabian Baths, they were set on the lime plastering of the walls and were fastened with iron nails. Such are likewise shown on the buildings in Treves. (Fragments in the Museum there). (Figs. 194, 195[146]).

Note 146. The illustrations in the "Architecture of the Romans (Baukunst der Römer) for the greater part are made from original drawings and monuments by the author.

129. Hollow Bricks.

Hollow bricks (tubuli, fictiles) were likewise employed instead of knob tiles in the most diverse dimensions and of rectangular or even circular section. Their walls were usually 0.79 to 0.98 in. thick, both ends were open, and they had slits of various shapes on the smaller sides. (Figs. 196, 197). In Augst (also in Museum at Basle) are such, that are only open at the upper end and have a larger opening on one wider side, in which were found marks of smoke and soot, and which served as smoke flues. They were fastened to the wall by mortar and by iron cramps. Water pipes of burned clay, rectangular, circular and semicircular in cross section, frequently with very carefully wrought junctions, were everywhere used in various dimensions.

Clay pots were employed to isolate from walls (compare buildings below the Palatine in Rome) and also in the walls and vault construction.

130. Light Bricks.

Bricks made of earth like pumice

130. Light Bricks.

Bricks made of earth like pumice stone, and which did not sink in water when dry, are mentioned by Vitruvius (Book II,8) and by Pliny (Book 35, 49). They must have been made at Pitana in Asia and in farther Spain.(also compare Strabo, Book. 13, 67).

131. Ceramic Mosaic.

Clay rods of the smallest sizes and many colors were also made and a finer mosaic executed therewith, as well as opus vermiculatum. Natural wall bricks of various colors resulted from the nature of the different chemical composition of the clays in burning. Light-yellow and dark-red bricks were in use, frequently alternating together in the same building in the most beautiful manner. (Compare Sedia del Diavolo and Temple of Deus Rediculus near Rome).

132. Colored Bricks.

The production of enamelled or variegated colored bricks, such as were known to the East and which "formed a chief splendor of Asiatic art." must have been well known to the Greeks and Romans.(Colored remains of bricks in Olympia, Syracuse, Metapontum, Selinus, etc.). The traditional painted coating of stucco on brick walls and also for terra cotta ornaments, with which men were contented, or the later common and much finer marble veneering, prevented their use indeed on a large scale.

133. Opus Signinum.

Likewise the fragments of bricks, of pottery warped in burning or broken, were still made useful , for they were broken into small pieces and mixed with lime mortar, producing an excellent concrete, or it was employed as a coating to aid in making the opus Signinum.(So-called from the city of Signia).

134. Roof Tiles.

Older than burned bricks are burned clay tiles, erroneously termed ceramoi, ceramides, and tegulae.

Their high antiquity is expressed by the mention of Pliny, (Book 7, 195), that Kinyeas on Cyprus invented the tile roof. In the best period of Athens, it was already general. The Etruscans were likewise acquainted with it; its use was also tolerably extended in Pompeii, since tiles with Oscan stamps are found there. Ischia supplied the cities of the gulf with tiles. 147.

[illegible]

[illegible] (Roman Times) [illegible]

[illegible] 1931, [illegible]
in [illegible] cover, [illegible]
[illegible]
[illegible] to prevent [illegible] (cal) [illegible]
[illegible] cover [illegible] of [illegible].
[illegible]
[illegible]. [illegible] of [illegible].
[illegible] thickness, [illegible] 0.79 [illegible] 0.89
[illegible] 1.18 [illegible]
[illegible] 1.19 to 1.[illegible] [illegible]
[illegible]
[illegible]. The [illegible] at the [illegible]
[illegible], while the [illegible] -
[illegible]. Fragments [illegible] of [illegible]
[illegible]
[illegible], and they were [illegible]
[illegible]. The cover tiles [illegible] received at the [illegible]
[illegible] a [illegible] sculptural [illegible], [illegible] a
[illegible]
[illegible] foliage [illegible].

[illegible] glazed [illegible], [illegible]
[illegible]. The [illegible] were [illegible] -
[illegible] from [illegible]
[illegible] were [illegible] in [illegible]
[illegible] pieces. [illegible]
[illegible]. The [illegible] cover tiles [illegible] -
[illegible], [illegible] — [illegible]
[illegible] and 2 [illegible].
[illegible] the flat [illegible].
[illegible] of the
[illegible] of the [illegible], [illegible]
[illegible], i.e., cover tiles were [illegible]
[illegible]. [illegible] of a flat [illegible], which [illegible]
[illegible], and [illegible] a [illegible].
[illegible] were [illegible]
[illegible]. [illegible]
[illegible]
[illegible]

Note 147. Compare Nissen. p. 23.

Roof tiles were of rectangular or trapezoidal form, and as in Greece, they consisted of slightly curved and flat tiles with edges bent up along the longer sides, the tegulae proper, and of conical or convex hollow tiles (calypteres, imbrices), which covered the upturned edges of the adjoining tegulae. The plane tiles were smooth on their under surfaces and without hooks. their dimensions varied as much as those of bricks. Not of uniform thickness, they diminish upwards from 0.79 to 0.39 inch. The average thickness is less than 1.18 inch, the upturned edge is 1.18 to 1.57 ins. high, not always extending to the upper surface. Beside the edges extend small grooves on the upper surface. The trapezoidal roof tiles have at the ends short sunken grooves, while the rectangular ones have them sunken obliquely. Fragments of tiles in the museums of Treves and Carlsruhe (the latter being from Badenweiler) show nail holes at about 2.16 ins. from the upper end, and they were therefore eave tiles. The cover tiles generally received at the eave of the roof a special sculptured ornamentation, for the exhibit a facing extending upwards, decorated by palm-leaves, naimal forms and foliage ornaments.

Besides these were also found special ridge, hip, gutter, and eave tiles. The ridge tiles were likewise hollow tiles of cylindrical form but with side junctions or openings for inserting the convex tiles and with enlarged joints in their length for receiving the ends of the separate pieces. The hip tiles were of similar shape. The plate-like gutter tiles (tegulae colliciares, deliciares -- pertaining to the water channels) had an irregular hexagonal shape with 4 long and 2 short sides; two longer sides had the same upturned edges as the flat tiles. Instead of convex tiles with antefixas as a termination of the roof surface at the eaves, there were arranged also continuous water gutters, i.e., eave tiles with collecting gutters and water spouts. They consisted of a flat surface, which partly extended beneath the flat roof tiles, and of a strongly curved decorated border (cyma), to which were attached the water spouts at regular distances. In some winds, the same effect occurred in the removal of water as for roofs without uater gutters and spouts. A collecting gutter not connected with a

down-spout has little practical value. The slightly curved tiles (tegulae) occurring in Greece in the earlier period with similar covering tiles may have come into use but seldom, as in the ruins or museums are usually found only the two kinds described.

In order to remove the smoke or to introduce air and light into the room beneath the roof, with the ordinary flat tiles were also those with openings of various forms and sizes. some of these may have been closed with mica or glass, as arrangements on tiles found in Pompeii permit us to conjecture. But besides those were in use also those furnished with covers and projections like dormers, which prevented the admission of the rain; undoubted examples in Pompeii and fragments from the buildings of the Zehntland are found in the museums of Mentz and Carlsruhe.

135. Brick Stamps.

The stamping of Roman ceramic products was pretty common or yet a widely extended custom. The name of the owner or special brick marks, or the number and name of a legion with the addition of the mark of the legion, are impressed, sometimes sunk, sometimes skilfully carved in the upper surface of the brick. (Compare the collection of hollow tiles with impressed brick stamps in Fig. 198.[148]). Original stamps of wood, clay, gypsum, soft stone, and of metal are preserved.

Note 148. Reproduced from Jacobi, L. Das Römercastell Saalberg. Hamburg. 1897. p. 200.

136. Moulded Bricks.

The bricks that were burned for the construction of columns probably form the intermediate step between roof tiles and bricks. Their use may be referred back in Pompeii to the middle of the 2 nd century B. C. (Basilica), while the wall bricks were first used there in the imperial period.

Last to be mentioned are the special moulded bricks and the architectural ornaments, such as terra cotta reliefs, cornices, frieze slabs, etc. Of the latter, we find the different pieces numbered and furnished with holes for nailing. In order to avoid too thick joints in round arches, voussoir bricks of special form were employed, to which reference is made in the Table on page 51.

137 Pottery.

That men already possessed the necessary skill in the production of great articles in terra cotta is proved by the clay sarcophaguses, bath tubs (Compare Capitol Museum in Rome), great vases and wine vats. Vitellius had a dish made, for which a special kiln was built in the country and which cost about $37,500. It was "as big as a pond and bore the name of 'Shield of Minerva.'" (Pliny, Book 35, 46). Fig 199 represents the form and construction of a kiln for burning.

The cities of Rhegium and Cumae were famous for their dishes; Samian and Arretian vessels were favorite pottery for the table.

138. Mortar.

The use of bricks in building assumes a cementing material, that combines the small parts into a whole, separated with difficulty. For walls of natural stone, the necessary stability could be secured by the bonding of courses and the weight of the materials; the connection of the separate parts together there remained purely mechanical. But in brick masonry, the cementing and the structural materials must enter into a chemical combination with each other, and this, with a proper bonding of the courses, must afford the required stability. In walls of rubble or of irregular and relatively small blocks of sandstone or limestone, besides its property of firmly connecting together the stones within a definite time, it likewise serves to level and fill the interspaces, left between the uncut or very slightly dressed stones, it also has to produce a uniform distribution of the pressure on the beds, in which the cohesion of good mortar should not be too lightly estimated.

In ashlar masonry, if the stones are carefully wrought, so that they are in close contact on their surfaces, the use of mortar has little value. If we now employ fine mortar or pure lime in setting ashlars, this serves more for leveling unevennesses and for the more uniform distribution of pressure thereby made possible, since we are no longer accustomed to dress the beds of the stones as carefully as did the ancients. We must therefore set them with open joints, while the joints of ashlars are rarely visible for the ancients. Our rapid construction and the limited means prevent our use of the antique practice. The method of execution invariably, always and ever again, depends upon the means at command, together with the

[illegible]

[illegible], [illegible] [illegible] of [illegible], [illegible]

[illegible].

[illegible]. [illegible] and [illegible].

[illegible] [illegible] [illegible] walls [illegible] [illegible] bricks [illegible] of [illegible] bricks [illegible] material. The use of [illegible] [illegible], [illegible], was [illegible].

Clay mortar was also certainly employed for [illegible] walls or [illegible] furnaces, as [illegible] case today; it may also have been [illegible] by unscrupulous contractors, in [illegible] of [illegible] [illegible] of [illegible] [illegible] walls of small [illegible] [illegible]. Complaints of the [illegible] of [illegible] of the [illegible] of [illegible] contractors are not rare, even in [illegible]. ([illegible] Pliny, [illegible], [illegible]). The existence of clay [illegible] and [illegible], especially in [illegible] or subterranean [illegible]. [illegible] [illegible] as [illegible] in a [illegible] of [illegible] by [illegible] of [illegible] at the [illegible] of [illegible], for example, at the [illegible] ([illegible]).

[illegible]. Lime [illegible].

The [illegible] [illegible] of [illegible] [illegible] [illegible] [illegible] of [illegible] [illegible] [illegible] [illegible]. It became known to the Greeks relatively late; it may have been [illegible] [illegible] 500 to 300 B.C. [illegible] concrete, [illegible] is first found in Italy about 300 B. C. in [illegible] and the temple of Alba Fucens.

[illegible] [illegible], [illegible] the "[illegible]" [illegible] [illegible] by [illegible] [illegible]." [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] "[illegible] [illegible] of [illegible] [illegible] [illegible] [illegible]." -- "[illegible] [illegible] the water, produces a [illegible], [illegible] by the [illegible]." Pliny, Hist. 36, [illegible].

again, depends upon the means at command, together with the skill of the workman.

139. Clay and Asphalt Mortar.

As the Egyptians today build the enclosing walls of their little houses with Nile mud as the cementing material, so may the walls of air-dried bricks have been constructed with clay as the binding material. The use of asphalt instead of mortar, described by Herodotus, was indeed limited to Asia.

Clay mortar was also certainly employed for brick walls of heating furnaces, as the case today; it may also have been smuggled in by unscrupulous contractors, in case of great lack of means or into the internal walls of small buildings at a later time. Complaints of the stealing of lime and of the fall of houses resulting therefrom are not rare, even in antiquity. (Compare Pliny, Book,36, 55). The existence of clay in the bed and end joints, especially in dumped or subterranean masonry, can furthermore in many cases be referred to a penetration of clayey earth by percolation of rain water in the course of time. (As, for example, at the Melone in Camuscia).

140. Lime Mortar.

The most important part in the development of the construction of the later architecture is played by lime mortar; the vaulted construction of the great style would have been impossible without this. It became known to the Greeks relatively late; it may have been introduced on European soil in 300 to 200 B.C.

The earliest opus caementicum, or masonry of lime mortar and stone spalls is first dated in Italy about 300 B. C. on the walls and the podium of the Temple of Alba Fucense.

Lime mortar came into most prominence, when men "recognized the valuable properties possessed by lime in combination with pozzulan." The first experiments therewith were made on the gulf of Naples. Strabo (Book V, 4) mentions Puteoli as a great commercial city, "since on account of the usability of its sand for artificial harbors, the design of great dykes in the sea made of the open shore a harbor, in which the largest freight ship could lie." -- "Puzzolana earth mixed with Cumaean mortar, deposited in the water, produced a monolithic stone, immovable by the waves."(Pliny, Book 35, 6).

Lime and sand were the simple materials to which architecture

owed so much.

141. Lime.

Lime should be burned from quarried stone or boulders, that from hard stones being used for mortar in masonry, and that from porous stone for plastering mortar. Cato rejected lime from variegated stone. The slaked lime was considered better, the older it was; according to an ancient rule, it should be kept wet for three years.

142. Sand.

Freshly dug sand is declared best by Vitruvius (Book II, 4); therefore it should not lie long in the sun. Only for plastering should dry sand be used. When rubbed in the hand, the best should grate, and if heaped on a white cloth and then thrown off, it should not soil this. Of pit sand, he mentions black, gray, red and reddish-brown (carbuncle),with reddish-brown in Etruria, also river sand or that sifted from gravel. He rejects sea sand, since it dries with difficulty and secretes a salty moisture.

For good mortar, to 3 parts pit sand must be added 1 part of lime, with 1/3 sifted brick dust in using river or sea sand. Pliny (Book 36, 52) prefers for pit sand 1/4 lime, for river or sea sand 1/3 lime, for mortar for building cisterns, 5 parts of clean sharp sand and 2 parts of strongly setting lime. Broken and pounded fragments of pottery mixed with the lime make the mortar stronger and more durable.(Pliny. Book 35,6).

143. Marble Mortar and Gypsum.

Marble mortar and gypsum were employed only for ornamental purposes. The latter was also dug as gypsum earth (Cyprus) or burned from stone.(Syria). The best was obtained from transparent gypsum. When wetted, its rapid use was recommended. The marble mortar must be worked so long before using it, that it would no longer hang from the trowel.(Pliny, Book 36-55,69).

On the use of gypsum and lime in the making of mortar, Delbrück (see his work) says:-- the burned gypsum should only be mixed with water just before its use, since it sets too quickly. This does not occur with lime! I believe the same for the use of clayey limes. But we learn yet further from the archaeologists concerning the matter:-- "Also men are not accustomed to burn lime mortar for a second time, since it is

chiefly mixed with sand, which is not the case with gypsum."(Sic!)

144. Wood.

"With trees we build dwellings, of trees we likewise make images of the gods." (Pliny. Book 12, 2). Wood is as ancient as a building material, and it is as important as stone. The lack or the existence or predominance of one or the other material gave in the different countries the impulse for the first beginning and the particular development of architecture. In the Hauran, an entirely treeless country, stone was the sole material and compelled stone construction, and we can follow this from the cave dwellings, which certainly extend back into the remotest antiquity [150], down to the perfected public and temple construction. Wooden construction could persist only in thinly populated regions rich in forests; the perishable nature of the material and massive construction in thickly populated countries soon caused a transition to a mixed method of construction, to combined wood and stone building.

Note 150. Baedeker's Palestina und Syrien. p. 125, 418. Leipzig. 1875).

The primary conditions for the latter existed in Italy and we also meet with it in Roman architecture. If no works in this mixed style have been preserved, in which we may show the different kinds of woods that came into use, yet the carbonized remains in Pompeii and the statements of ancient writers afford for us conclusions concerning them and their use. Walnut, oak, chestnut, beech, and pine wood are shown in that city. The firs and pines of Latium are praised by Theophrastus; (History of Plants, V, 8); concerning the abundance of wood in Tyrrhenia, which furnished the straightest and largest beams for building houses, and especially that of Pisa, (trabo writes; (Book V, 2, 5); Vitruvius mentions the existence of larches on the banks of the Po and on the coasts of the Adriatic sea. The same writer (Book II, 9) and Pliny (Book 16) mention the following kinds of woods and their uses for practical purposes, which remain the same today. White pine, larch, beech, winter oak, zirn oak, hornbeam, ash, alder, elm, walnut, poplar, linden, willow, fir, cypress, cedar, etc.

A list of the structural woods found in the excavations on the Saalburg is given by Jacobi in his book already mentioned. [151]

Note 151. pp. 179, 180.

Pines and larches were recommended for beams on account of their important resistance to bending, and the oaks for pillars for their resistance to compression. Larch wood is esteemed indestructible in Vitruvius. "If this wood were easily transported to Rome, then would it have the greatest use in buildings."

145. Durability of Woods.

Concerning the durability of woods, Pliny says in a very general way, that those species of wood with an agreeable odor are also durable. He esteemed as best the yew, cypress and cedar, and as evidence served the roof of the Temple of Diana at Ephesus, that consisted of cedar beams; further the leaves of the door there, made of cypress wood, which still appeared new, although 400 years old. These had remained for 4 years in the glueing clamps! The juniper beams of the Temple of Diana in Saguntum still remained at that time, and which had been placed 200 years before the destruction of Troy!

Rot and age did not attack cypress, cedar, beech, yew, juniper and olive, and only after a long time larch, winter oak, cork oak, chestnut and walnut; no cracks formed in cedar, cypress, olive or beech, which indeed were only to be found when these woods were technically very skilfully employed in accordance with their peculiarities.

146. Size and Age of Trees.

Concerning the size and age of trees, we learn (Pliny. Book. 16), for example, that on a hill in the vicinity of Rome stood a stone oak about 33 ft. in circumference, and that a stone oak was also shown on the Vatican hill, whose age exceeded that of the city: it bore an inscription with bronze Etruscan letters.

Tiberius exhibited a larch trunk 118 ft. long, which had a uniform diameter of 1.97 ft.; a beam left after the building of the Diribitorium was 1.48 ft. thick and 98.3 ft. long. On the ship, which Caligula had built for transporting an obelisk, was a white pine, whose trunk 4 men could scarcely circumspan and for which about $3250 was paid. Cedars of like size are mentioned in Cyprus.

147. Uses and Time of Cutting Woods.

The recently followed practice for Englishmen to employ wood felled in sap or the green for ship-building was already in

use by the Romans. Duilius started with his fleet under sail 60 days after the felling of the trees, and Scipio in the second Punic war, 40 days after the time of felling.

As the right time for felling wood for building purposes, Vitruvius and Pliny designate the days from harvest until the new year ("from the longest day till the appearance of the west wind"). Whenever possible, we follow the same rule today: adherence to it depends on local conditions. The quick change of the timber into money has also an influence.

Fikewise for the condition of the moon, both require attention, for they consider the time between the 20 th and 30 th of the month as most suitable. Best for felling round timbers is the time at which the tree buds, since the bark does not peel later.

As to the method of felling, it is advised to cut the tree to the heart, so that the sap may dry out, then felling it completely.

Cato, "the most experienced of all the more important men," advised:-- "Handle wood for building when the moon is new or half; then must you neither dig it out nor cut it down to the ground; this is best done within the next seven days, in which the moon is full. In every case, beware of cutting, felling or handling wood, if it be not dry, or when it is frozen or bedewed."[152]

Note 152. A pretty comprehensive enumeration of the most important useful woods of the ancients and their uses is to be found in Blümner, p. 245-311. -- The best ancient source for this is Theophrastus.

148. Metals.

Of the metals were employed particularly iron, lead, tin, genuine and imitation bronze, which were used for technical purposes, though certainly not to the wide extent of modern practice. The noble metals, gold and silver, were wrought into ornamental articles and art works, beaten thin for overlaying bronzes and sculptures in the most diverse materials, or were added in the production of artificial metals.

149. Iron.

Iron, "the best and the worst tool in life," was yielded from antiquity by the mines of Ilva (elba, see Art. 10), thus being obtained in the country itself. Cappadocia also furnished

obtained in the country itself. Cappadocia also furnished good ore. Pliny (Book 34, 39) designates the Serian as best, next it being the Parthian iron, both malleable ores. As iron manufactures were famous the products of Bibilis and Turiasso in Spain and of Comum in Italy. In architecture we chiefly see only bars, champs, dowells, pins, hooks, nails, locks, and tools of all kinds made of this material. Men endeavored to protect it from rust by cast lead or by coatings of white lead, gypsum, and liquid pitch.

150. Lead and Tin.

In lead are distinguished the black and the white; the latter was the more costly. From the former were made pipes and covering plates (sheet lead ?). Lead water pipes with Roman stamps are found everywhere and in all sectional dimensions, some of them being still in use in Italy -- the best evidence of their good quality. Tin was employed for making mirrors, the best of which were made at Brundusium; bronze vessels were also covered with it, in order to avoid the unpleasant taste and to prevent the formation of verdrgris.

151. Bronze and Copper.

Wrought bronze, or according to the contemporary name, wrought copper (cuprum nativum), according to Pliny (Book 34, 1,2), was mined and refined by fire. In his own country it was formerly found in Campania, then in the region of the Bergomats, the extreme part of Italy. The Sallustian ore, that in the Alpine region of Centro, and the Livian in Gaul were quickly exhausted. The highest esteem was later enjoyed by the Marian (Sierra Morena ?) or Cordovan.

The first ore was discovered in Cyprus and was obtained from chalcites (ore-stone, copper-gravel). Its chief use was that of money. What was elsewhere termed bronze was an artificial product. Pliny complains of the decadence of the art of casting bronze; "men no longer practice it as formerly for fame, but as in everything, for gain."

The use of this artificial bronze, the bronze of our own time, for images of the gods (the first in Rome being a Ceres, 485 B.C), statues, thresholds, leaves of the doors of temples, and for furniture of all kinds, such as table legs, bedsteads, ornamental tables, tripods, lanterns, lamps, candelabras, mugs, pails, etc., was very extensive. It very seldom

etc., was very extensive. It very seldom found employment as a connecting material in building, since iron was the preferred material for this, in accordance with Grecian traditions.

Its use for capitals of columns is vouched for by Pliny (Book 34, 7), who mentions such in the portico with two rows of columns near the Flaminian Circus, built by Cn. Octavius, and in the Pantheon of M. Agrippa; likewise the capitals of the Temple in Palmyra must have been of this material.[153]

Note 153. Compare Socin. p. 547.

Earliest famed was the bronze of Delos; that of Egina, for its composition; that of Cyprus was thinned in leaves as garlands and as ductile (bronze bars); that of Campania for furniture and vessels. Corinthian bronze was even preferred to silver and gold.

Men distinguished between three kinds of this "noble bronze," a white, in which silver predominated; a yellow, chiefly composed of gold, and a third with the addition of equal parts of gold and silver. That mixed after the decadence had the color of liver, was less esteemed, and was termed liver bronze. The ancients coated bronze plates with mineral pitch; they were later gilded.

As a structural material, we find bronze in the framework of the roof of the portico of the Pantheon (Fig. 200), and as a covering material in the interior of the dome of the Pantheon. Portions of the latter yet remain on the sides of the skylight in the crown of the dome. It is mentioned by Pliny (Book 30, 7) as a covering material on the Temple of Vesta in Rome, whose roof was covered with Syracusan bronze. The tiles of the Temple of Rome and Venus were of gilded bronze.

152. Glass.

Opaque glass (enamel) for overlaying or coating ceramic articles, terra cotta, bricks and metal (cloissonnee and champleve enamels) was already employed in Egypt in the earliest period, and it can be referred in different ways back to Mencheres, (4 th dynasty, 3122-2956 B.C), as proved by the royal cartouches. The art of glassmaking has been preserved to us, illustrated in the reliefs of Beni-Hassan-el-Gadin. They date from the time of the 18 th dynasty (1597-1447 B.C). Casting and blowing were accordingly known. The name of Thutmes III gleams

on a small iridescent cup. Painted glass articles can be dated back to 1900 B. C. in Thebes.

The Assyrians were likewise early engaged in glassmaking. In the ruins of Nineveh (discoveries of Layard and of Botta) were found round glass vases with inscriptions of king Sargon, who reigned in the 17 th century B. C. The glass ware of Sidon was famous; but the best period of the city occurred between 1600 and 1100 B. C.

Men were not satisfied in Asia with the manufacture of small glass articles: vessels were cast so large, that a corpse might be placed therein. (See text). Refined and tasteful are the glass wares of the Etruscans' they recall those of Egyptian art.

Since a sand exists on the coasts of Cumae, which is suitable for glassmaking, we may well assume that the workers in glass settled at an early date in Campania and at Cumae. Advances in the making of glass on Roman soil are shown by the legend, that malleable glass was made under the Tiber. The light glass was an actual fact under Nero, the "nimbus vitreus" of Martila, $150 being paid for single articles of this wares. Its vast and varied use for vessels, for containing liquids, fruits, vegetables, essences and drugs, for enclosing articles instead of paper or cloth, for hour-glasses and water clocks, lamps, urns for ashes, toilet articles, beads, bracelets and necklaces, for optical instruments (magnifying lenses), the combination of bronze and glass (compare Pliny, Books 45 and 63) in antiquity are well known and refer too little to building construction. On the other hand, the production of plate glass and its use was decisive in the treatment of architecture. If we follow the development of this branch of manufacture and its applications until today, no material, excepting iron, has produced such a revolution in the domain of architecture.

153. Plate Glass.

It is indeed certain, that mica was already early used as a transparent enclosure; but plate glass was employed quite as extensively in the imperial period, and indeed in not small dimensions. In Pompeii are found in place, in the Museum of Naples are small pieces, and in the collection of the Louvre is a piece 9.8 × 7.5 ins., 1.57 to 1.96 ins. thick. In the year 1881, there were found in Pompeii glass panes 11.8 × 14.3

ins, and in 1862 at a sitting of the Academy of Sciences in Paris, cast plates from Herculaneum, 27.5 × 15.7 ins., attracted the attention of the savants.[154]

Note 154. Compare Deville, A. Histoire de la Verrerie dans l'Antiquite. Paris. 1871. p. 96, 97).

Analysis yielded approximately the same composition as that of our modern glass.[155]

	Antique.	Modern.
Silica	69.	68
Soda	17	17
Lime	7	9
Aluminum	3	4
Iron oxide	1	6

Note 155. Compare Allgemeine Bauzeitung. 1863. p. 246; window glass in Pompeii according to Mazois and Bontemps.

Antiquity was acquainted with three kinds of glass:--

1. Opaque or porcelain glass (vitrum obsidianum) in different colors.
2. Translucent or horn glass (vitrum translucidum).
3. White crystal glass(vitrum purum).

The glass was composed of silica, lime and soda, thus being a soda glass, while we chiefly make a potash glass today. To the soda glass were also added lead oxide and iron oxide, which produced a surface of oxide, that became iridescent.

The plate glass for closing windows appears on this side of the Alps to have been produced by casting on a surface covered with fine sand, and which was enclosed by a border. The thickness of this glass is irregular, frequently being only.08 in. at the centre, but up to .20 in. at the always rounded corners. This glass is not transparent but translucent, one side being somewhat rough and the other smooth, and it is thicker at the edges.[156]

Note 156. Also compare Jacobi. p. 121.

In the Museum at Treves are found Roman glass plates of greenish but entirely transparent glass. On a piece from the Roman Villa near Wustweiler "may be plainly recognized the production by pulling with tongs the glass cast on a slab." The ancient leading still remains on a piece with corrugations.[157]

Note 157. Compare Hettner, F. Illustrirter Führer durch das

Provinzialmuseum in Trier. 1903. p. 114.

Aquileia (Roman colony in 181 B.C) was famous for its glass manufacture. The existence of exleccent raw material, a fine clay (saldame) on the Istrian peninsula already in antiquity fawored a local industry in that place. The Venetians also obtained here the crude material for their glass factories, and the modern glass industry of Venice is merely a continuation of the ancient one of Aquileia.

154. Glass Windows.

Philo, who led to Caligula an embassy of Jews from Alexandria, from whom the former ordered the glass windows for enclosing a great hall, which Philo very plainly distinguishes from those of mica.(See text for quotation).

Pliny has the galleries in his Laurentinum closed with glass, and Juvenal, a sedan chair. Lactantius (De Opificio Dei), living about the end of the 3 rd century, speaks of ..."windows closed with glass or transparent stone."

Evidence of glass windows in the middle of the 4 th century is contributed by St. Jerome:-- "windows, which were closed by glass cast in thin sheets." Thin plates of cast glass in the windows!

In the time of Sulla, the stage walls of theatres were adorned by glass plates or glass mosaics, these also later decorated the floors, the ceilings and vaults. Seneca says:-- "men were esteemed poor in his era, whose ceilings were not supplied with glass," and Pliny (Book 36, 64) states, that Agrippa would have had the vaults of his Baths made of glass, if this invention had then been made. This can indeed only refer to openings in the vaults themselves, filled with glass, or more properly to the glass mosaics on the surfaces of the vaults.

The requirement of "more light and air", opposed to the ancient arrangements, always increased with the growing luxury, with which it likewise goes hand in hand today.

155. Glass Mirrors.

The use of glass mirrors may likewise be referred to an early date, if we recall an expression of Aristotle, who says:--"Glass and crystal require a plate of metal to reflect the image placed before them."

Seneca (Quest. Nat. Book I, 13) says in regard to the exist-

existence and use of glass mirrors in Rome; -- "men used such of life size of man, adorned with gold, silver and precious stones. They were either fixed on the wall as a permanent decoration of the room, or they were arranged with counterweights so as to be movable." It is not there stated that these mirrors were made of a single piece of glass; they might have consisted of two pieces in height. Glass plates 2.30 ft. in dimensions have already been found.

The color scale of antiquity was not so rich as that of our time, although it contained those tints necessary for undertaking everything in polychrome, that even the modern eye demands. Vitruvius (Book 7, 7) distinguishes between natural and artificial colors. In the first he includes ochre, vermilion, mountain green, Armenian blue and indigo; most of these colors were not found in Italy. Among the artificial colors he places Black, burnt ochre, white lead, verdigris, steel blue and purple. The color last mentioned was obtained from sea shell-fish and did not have the same tint everywhere. It was dark-blueish in the Northern countries, violet in the Eastern and Western regions of the occurrence of the shell-fish, and deep red in the southern.

He says of vermilion, that it was also adulterated; substitutes were taken from plants and flowers (madder roots and hyacinth flowers) for purple and indigo.

We see from the preceding, that Roman architecture had at command nearly as extensive means as modern, even if certain materials were less extensively employed than in the latter.

Chapter 4. Walls, Pillars and Arches.

"....Moreover, it is in the power of the master, whether he will build in bricks, in rubble, or in ashlar masonry. There fore three things are considered in public estimation, particularly in reference to care in execution, magnificent decoration, and the arrangement of plan. If we observe a structure splendidly executed on the part of the master, then will he praise the expenditure; if it be carefully constructed, then will the accuracy of the superintendent receive recognition, but if the entirety produced with reference to harmonious numerical and magnitude proportions be conspicuous, then will fame be due to the architect.

Vitruvius. Book VI, 8, 9.

157. Masonry.

That in these three ways fame was due to the Romans in most cases is proved by the works left by them. Grandly designed, well considered in construction, and mostly excellent in construction, they exist in their ruins as buildings demanding consideration. We find their walls erected with natural or artificial materials in great blocks or of small and carefully cut ashlars or of bricks.

158. Ashlar Walls.

The oldest walls in Italy built of ashlars are not Roman undertakings. Greek colonists, Latins and Etruscans wrought therein earlier and have left mighty models in their city walls. Those of the latter have have already been described in the preceding volume of this Handbook. (2 nd edit.).

Polygonal and rectangular coursing occur. The former is not always in Italy evidence of high antiquity, for it was still constructed in the late period also, as shown by the Cyclopean walls in Praeneste of the era of Sulla.

Etruscans and Greeks remained the instructors, to whose rules men adhered until in the latest period. That the former were long the constructing mechanics for Rome has already been stated. The Etruscan bond is found in all ashlar walls until in the Augustan period. (Compare the completed walls of the Temple of Mars Ultor in Rome, i.e., on the Forum of Augustus (Arco de' Patani).

159. Form and Dimensions of Ashlars.

For ashlars of tufa, limestone and marble, the ratio of the height to the length varies between the limits of 1 to 1 up to 1 to 5. (Figs. 201, 202).

For ashlars, a height of 1.97 ft. remains a favorite one on account of Etruscan traditions. For example, compare the ashlar masonry at the Tabularium, the foundation masonry of the so-called Temple of Vesta in Rome, the masonry of the walls of Porta Nigra in Treves and many others. The use of massive blocks is not there excluded, as for example in Treves for some springing courses of the Amphitreatre may be specified stones 20.2 to 23.5 ft. long, and in the Amphitheatre in Nimes and that at Arles are stones over 16.4 ft. long.

The surfaces of the ashlars were either rubbed smooth and cut sharply rectangular at the edges, or the long marks of the tooth-axe remained. These were combined into a sketch or a linear ornament, a motive that occurs on the mosaic pavements in Treves and its vicinity, and it is likewise found on the ashlars of the substructure of the so-called Tomb of Arun (also termed that of the Curiatii and Horatii) near Albano. "Restored in the year 1887" is on the monument mentioned, it is not impossible, that at this time was added a part of the fanciful treatment of the faces of the ashlars.

160. Faces of Ashlars.

In using marble, the faces are as carefully smoothed as for the ashlars of Grecian temple cells of the best period. (Compare the Temples in the Hauran, the so-called Temple of Vesta in Rome, and others). Etruscan models are followed by the ashlars with faces regularly curved on the four edges and without drafted margins. Executed in a masterly manner and splendidly preserved (almost like new) is this dresing of the ashlars on the Forum of Augustus in Rome.(Fig. 201).

The ashlars with bosses and with drafted margins enclosing the face, with long strokes that may still be counted, are to be found everywhere in accordance with prior examples in Asia minor, Greece and Etruria.

Parts of the Servian wall, pieces of the Aqueduct Marcia, courses of the so-called Roma quadrata on the Palatine and the stylobate of the Temple of Castor on the Roman Forum exhibit

this treatment.(Figs. 203, 204, 205). Systematically executed ashlar masonry with bosses and drafted margins extending over large wall surfaces is rarely found or preserved on Roman works in Italy.

Ashlars with drafted margins and finely pointed surfaces are found in the interior of the so-called Temple of Vesta in Rome, probably being there intended to receive plastering.

161. Joints.

On the same building, the end and bed joints of the masonry of the cell are especially emphasized. What the Greek mechanics sought to carefully conceal by highly developed technical skill, the joints in ashlar masonry, here become a decorative element. With correct feeling, end and bed joints are similarly ornamented, and a modern error in neglecting the end joints or not making them correspond to the accenting of the bed joints was avoided,[158] and which imparts to the masonry an impression of weakness.

Note 158. Compare Semper. Vol. 2. p. 365. Footnote.

The smooth faces of the ashlars were separated from each other by sunken triangular or rectangular joints (Figs. 205,206), an ornamental motive producing a simple and bold shadow effect.

False end joints are found occasionally on ancient ashlar masonry, though only rarely.[159] We find them systematically executed on the circular structure of the Tomb of Cecilia Metella. The external surface of the work imitates throughout ashlars of equal dimensions with a regular alternation of the joints, while the construction is executed with headers and stretchers alternating in the same course. According to the courses, one or sometimes two false joints are cut in a stretcher.(Fig. 207).

Note 159. See page 366 for data concerning this.

162. "Pseudisodomic" Ashlar Work.

The ashlar masonry preferred in the era of Alexander, with courses of unequal height, the so-called pseudisodomum of Vitruvius,[160] was also constructed in the imperial period.

Note 160. Concerning this incorrect appellation, see the same, page 360; footnote.

Ashlar walls of unimposing or material of little resistance, for example of tufa, were frequently faced with slabs of more substantial and valuable materials.

163. Coursing.

According to Grecian models, the stones in massive ashlar masonry were arranged to bond as headers and stretchers, the stretchers being set flush on the inside and outside, leaving a vacant space in the interior of the wall, while the headers extended through the entire thickness of the wall. (compare in Fig. 208, Temple of the Sun at Gerasa and Temple of Victory in Suleim).

A bonding, that indeed owes its origin to the fact, that the surfaces of ashlars in the interiors should be plastered and also that plastering adheres badly to large surfaces of stone, was executed on the so-called Temple of Vesta in Rome. The number of bed joints is increased in the interior, thereby producing smaller ashlar surfaces between the joints.

164. Jointing.

The stones touch each other closely on the bed surfaces; the jointing is unusually perfect; the ashlars are in contact at the end joints, in accordance with Greek methods, only on narrow borders, in order to there produce without great labor the beautiful fine jointing already mentioned. This procedure was observed until the latest period.(Fig. 209).

165. Bonding of Ashlars.

The use of metal could be and must be rejected under such conditions. The stones were ensured against displacement or slipping by inserted double dovetails, cramps and dowells. The bond and weight of the stones afforded the necessary resistance. In Egyptian, Lydian, Persian, Grecian, Etruscan and accordingly early Roman, and likewise in Syrian ashlar walls are found dovetails for joining the stones.

The H-cramps were essentially preferred by the Greeks, while the Romans were usually satisfied with the simple cramps bent down at both ends.(Compare Figs. 200, 210, and the method of fastening, in the preceding volume of this Handbook,2nd edit.).

In accordance with Grecian custom, iron was likewise the usual connecting material in Roman ashlar structures; other materials form the exceptions.

The exclusive use of iron and lead on the Theseion, on the little Temple of Nike, on the Erectheion, on the Parthenon, on the Olympeion, on Egina, in Sardis, on the Temple of Zeus in Olympia, on the Temple of Poseidon at Paestum, on the Temples

in Selinus, on the Propyleions in Athens and in Eleusis, on the Gates of Hadrian and of the Market in Athens, etc., is well known and its existence is proved by Bötticher, Hoffer, Penrose, Hittorf, "iron cramps set with lead"), Choisy ("these cramps were made of iron by the Greeks; they never made them of bronze; and lead was the only material that served them in fastening the cramps to the stone") and many others, whose evidence the author adds to his sketches.

Cramps of iron in cast lead were also described by Hauser on the Doric marble Temple and on the Arsinoeion on Samothrace. (Untersuchungen. 1875. p. 71, 72).

Bronze dowells set in cast lead and bronze dowell shells are verified on the Ptolemaion on Samothrace (Compare Untersuchungen. 1880), while the material of the dowells within the shells and that of the cramps remains unknown.

Dovetails of wood, lead, and of bronze are shown in Egypt, Lydia, on Samothrace, in Italy and in Alsace, with wooden guide pins on almost all Doric monuments.(See the preceding volume of this Handbook). Iron was employed on the Temple of Vesta, the Colosseum, the Triumphal Arches, the Temple of Faustina in Rome, on Porta Nigra in Treves, on the Temples in Baalbec, etc., in brief on all ashlar structures in all the provinces, and it is yet preserved, so far as the avarice of later generations has 161 not destroyed them. Complaints about this occur everywhere. Iron and lead-covered cramps were likewise recommended by Vitruvius. (Book II, 8).

Note 161. Compare the preceding volume of this Handbook, 2 nd edition; lastly, Socin, p. 518; - "The barbarism of the Arabs and Turks has made holes in various places in order to extract these iron cramps."

166. "Isodomic" Masonry; "Emplecton".

When the stones have the same widths and heights and succeed each other throughout in courses of equal height, this coursing is termed "isodomos". (Pliny, Book 36, 51). Masonry, whose mass consists of medium and small rubble and mortar and which is only faced with ashlars on the exterior, was designated by "emplecton".(Pliny, Book 36 and Vitruvius, Book II,8). This masonry might appear externally as isodomic or pseudisodomic. Without the use of headers (diatomoi) or fasteneng by iron cramps,

these walls were little recommended, and they were also justly condemned by Vitruvius.

The present condition of the substructure of the Tomb of Cecilia Metella and of the Tomb of Arun near Albano affords sufficient information concerning the construction of the Emplecton.

On the former, we find headers set at distances of 7.45 ft. extending deeply into the concrete masonry constructed with mortar, between which were placed the thinner stretchers. Since the latter were easily detached, they have been gradually stolen, while the former being too firmly fixed, they have remained until now in their original places.

Less economical but more substantial is the construction near Albano. There entire courses of headers extend into the concrete masonry, and this arrangement shows that the latter was leveled up with each course of ashlars, thus being executed at the same time. (Fig. 211). The stretchers have in part suffered the same fate as those on the Tomb of Metella.

167. Facings.

Judging from the still existing remains of built-in headers, the so-called Eichelstein (Oakstone)[162] must have been constructed in a similar manner.

Note 162. An extended description of this by Ufinger and Velke, although with statements not quite technically correct, is to be found in Zeits. des Vereines zur Erforschung der Rheinischen Geschichte und Alterthümer in Mainz. 1883.

These facing ashlars have an average height of 1.97 to 2.30 ft. But they were likewise reduced to much smaller dimensions, not much larger than bricks, and were wrought in uniform sizes for use. The surfaces of these stones are only leveled with the mason's hammer, though very carefully so, and they are employed in blocks of 0.40 to 0.62 ft. long, 0.26 to 0.33 ft. high and 0.53 to 0.66 ft. wide, extending back in triangular form. They were set with mortar, the adhesive strength of this must compensate for the lack in weight and dimensions of the stones. Then the dimensions of the small facing ashlars correspond to those of the inner rubble stones, and an unequal setting between the facing and the wall masonry was no longer possible. Badenweiler and Treves exhibit important remains of this kind of masonry, which are wrought with extreme care and

are well preserved. Likewise on the Aqueduct near Ars-sur-Moselle are such executed in dimensions of 0.28 ft. high and 0.53 to 0.58 ft. long; the thickness of the mortar joints varies from 0.22 to 0.39 or 0.49 inch; the angle stones are even 0.98 ft. long. Coursed stones 0.49 ft. high and with irregular lengths and widths, whose present condition suggests a very careful jointing formerly, are still found in a pier of the Aqueduct Zalbach=Mentz. Coursed stone facings alternating with courses of bricks are particularly well preserved on the Baths at Treves.(Fig.212).

168. Opus Reticulatum.

Besides these small rectangular stones were also employed by preference die-shaped stones or the so-called net-stones (opus reticulatum, structura reticulata), most commonly indeed in Rome. The visible surfaces were square with sides of 2.35 to 2.75 ins., wrought rectangular to a depth of about 1.58 ins., then irregularly pointed toward the interior of the wall and set in diagonal courses. The mortar joints were 0.20, 0.39 and 0.59 in. thick. Since no edges or angles could be constructed with these die-stones, we find them always used in combination with ashlars or bricks, which extended horizontally across the masonry at certain distances. The censure of Vitruvius in relation to opus reticulatum is not justified in view of its excellent preservation. (Beautiful pieces remain on the Villa Hadrian near Tivoli, also perfectly executed on Villa Gordian near Rome (Fig. 213); the buttresses 2.62 ft. wide and projecting 7.06 ft. and the segmental walls are masterpieces in execution. Here will "the accuracy of the master of the work find recognition" in the fullest degree.(Fig. 213). Fine examples likewise remain in Pompeii and its vicinity.

Although the ornamental had degenerated in time from which date these remains, yet there remained on the other hand at its climax, an extremely good and even fine technical skill. While the art forms became involved, ordinary mechanical work continued at its height or even made progress.

169. Rubble Masonry.

When the stones were but slightly and irregularly dressed with the mason's hammer and the unevennesses were leveled with mortar, there was produced the ordinary rubble masonry, the opus incertum or opus antiquum.(Vitruvius, Book. II,8).

It required the most and the best mortar likewise, on the binding strength of which was based the stability of the masonry. Compare in this respect the city walls of Aosta of the Augustan period, built of pebbles, whose mortar has become as hard as steel.(Fig. 214, d). The cell wall of the so-called Temple of Vesta at Tivoli is constructed in this manner and still remains, likewise the walls of various better buildings in Rome and vicinity, the walls of many houses in Pompeii, etc. This masonry is more frequently alternated with horizontal courses of bricks, that are arranged at distances of 0.59 to 2.63 ft.

Semper prefers to find in opus incertum and reticulatum the same advantages afforded by polygonal masonry; the binding strength of the excellent mortar of Pozzulana takes the place of the weight of the latter.[163].

Note 163. Compare Semper. Vol. 2. p. 380.

170. Anchoring of Walls.

For a greater degree of stability of walls, Vitruvius (Book. I, 5, 3) requires the insertion of slightly charred beams of olive wood, binding the thickness of the wall together, "so that the two external faces of the walls may have eternal duration, being bound togetherby these beams as by cramps."

171. Walls of River boulders.

Walls of river boulders (large pieces of conglomerate) are likewise found on the larger structures together with ashlar and brick masonry. On the Amphitheatre in Verona, the conglomerate masonry is placed directly above the massive ashlar voussoirs in the interior and it alternates with horizontal courses of bricks. There usually occur 9 courses of large stones and then 3 of bricks. The Adige certainly urged this material upon the builders. The conglomerate masonry in Aosta is faced with courses of small ashlars, which are there cut with the point. (Fig. 214, d, e, f).

172. Opus Spicatum.

Herring-bone courses are (as a bad caprice) to be found at a later time in rubble and brick masonry.(Fig. 215, examples from Messkirch and Verona).

163. Walls of Spalls and of Concrete.

The masonry of spalls, of concrete, or of a mixture(walls of spalls or small broken stones of all kinds with abundant

addition of mortar) was designated as diatoichos -- diamichton. (Pliny, Book 36, 51). What was thereby saved in wages and dressed stones was at least in great part lost by the increased use of mortar. The concrete masonry for foundations was constructed between wooden forms or walls of firm earth; but it was of far greater value in vaulted construction.(Fig. 214, a, a', b, b'.[164]).

Note 164. Compare Choisy, A. L'Art de Batir chez les Romains. Paris. 1873.

If we visit the great ruins of the buildings on the Palatine hill, that imperiously demand their "royal rights," we see in the concrete walls rectangular vertical recesses measuring 4.7 × 6.7 ins. at average distances of 3.28 ft., with horizontal divisions between them at distances of about 7.9 ins. From these may we learn of the wooden forms required in constructing the concrete walls. In the grooves were set the vertical timbers; the horizontal divisions are the marks left in the soft mortar by the plank form. (Fig. 214, a, a'). At Easter in 1903, the foundations of the Temple of Castor (Temple of Dioscurii) on the Roman Forum were uncovered, on which instead of the vertical recesses, horizontal ones appeared at distances of 1.15 ft., in which were again found square openings at distances of 6.07 ft. (Fig. 214, b, b'). In the lowest near the bottom of the foundation still remained the original timbers, which were 4.3 ins. wide and 10.2 ins. high, made of white fir wood.[165] They exhibited smoothly dressed surfaces and had square cleanly cut holes, and in spite of their remaining for about 2000 years in replaced earth, they were still well preserved, so that they could be cut with a saw. The wooden timbers had been cemented fast in the lowest recess and were left by the workmen when removing the planks, which may well have been arranged as in Fig. 214, b.

Note 165. According to the investigation of Professor Dr. Klein at the Technische Hochschule at Carlsruhe.

"But good masonry should be executed by the square and level and accord with the plumb line" (Pliny, Book 36), -- thus having no curvatures.

174. Stone Framed Work.

A peculiar masonry, first found in Pompeii[166] and only bel-

belonging there to the buildings of the earlier period, is the framed work of limestone, in which loam is employed as the cementing material; this was to level the unevennesses between the rubble and ashlars and to fill any cavities. corners and door jambs were made of the latter, and the intermediate wall piers were composed of vertical and horizontal stone beams, filled in with intermediate rubble masonry.

Note 166. Compare Mau, A. Pompeii in Leben und Kunst. Leipzig. 1900. p. 31. (Also English translation).

This method of constructing walls was retained in the African colonies until the late Roman period. The stone framed work of the Forum at Timgad (Fig. 216) and yet more that of the Temple at Dougga (Fig. 217[167]) can afford evidence thereof.

Note 167. Reproduced from Les Monuments Historiques. Paris. 1898. p. 3.

175. Stone Masons' Marks.

Stone masons' marks (setting or working marks) also occur in accordance with Grecian and Etruscan models (Compare the ashlars of the Arsinoeion on Samothrace and of the Servian Wall in Rome) and here as there consist of letters or numerical signs. Such are preserved on the external surfaces of the ashlars, for example, on the Porta Nigra in Treves, on the Arch of Triumph in Orange, and in Pompeii (Figs. 218, 219). Coinciding on the two monuments mentioned are chiefly three letters collected from the different stones. Orange exhibits C I S and C I D, Treves I I S and A C E, etc. The peculiar A of these marks is also preserved on the stones of the window enclosures of the megalithic fortress of Mammaertshofen in Thurgau.

176. Brick Walls.

Whatever relates to the bond and coursing of walls of bricks follows the same rules as for those of natural stones. For thin walls Vitruvius recommends the use of alternating whole and half bricks in a course with due attention to the breaking of joints in the interior and on the external face of the wall. (Book II, 3).

But the use of half bricks was also transferred to walls of more than 1 1/2 bricks in thickness, retaining the given alternation of joints. Walls entirely constructed of bricks with-

without the use or combination of a different material are relatively rare. For example, they do not occur in Pompeii. Yet Treves preserves again in its Basilica an entirely brick structure in the great style, such as is not again found from the Alps to Mt. Etna. The execution of it is excellent, and the long courses continue in faultless horizontal lines free from any curvature.

177. Concrete Walls with Brick Facings.

In by far the most numerous cases, the material is employed with the same economy as ashlars in "emplecton" or "diamicton". The smallness of the facing material requires an internal masonry in mortar, composed of pieces as small as possible, in order to avoid irregular settlement. This was frequently tied together by horizontal tile bonds, especially in thick walls, as for example, the concrete walls of the Baths of Caracalla are 6.24 ft. thick, are externally faced with bricks, and are horizontally intersected by great bipedal tiles at distances of 4.27 ft. (VIII in Fig. 220).

The concrete masonry was also indeed executed at the same time as the masonry facing, and it was leveled up with the courses of the latter. The layers in which such walls are built certainly remained undisturbed for several days after their completion, in order to produce the most uniform hardening possible and a setting of the mass before further work.

178. Triangular Face Bricks.

The greatest economy is shown by the use of triangular face bricks, since in this way only half as much material was employed. It was applied in the construction of the shafts of columns, the longer side of the brick being outward and the nucleus being composed of ordinary bricks or brick bats. (V, VI, VII in Fig. 220). Opus reticulatum of bricks is very rare and in Pompeii, for example, it is not found.

179. Mortar and Mortar Joints.

For walls was sometimes employed mortar with very fine sand, sometimes with coarse sand, and also that with the addition of pounded bricks, according to whether rough brickwork or facing was to be produced. In accordance therewith are likewise the thickness of the joints. At the so-called Sedia del Diavolo,

this technically perfected ordinary brickwork, the joints are but 0.20 in. thick for a thickness of 1.18 ins. for the bricks; on the Villa of Gordian, they are 0.79 in. for the bricks of the same thickness, and on the Basilica in Treves are as thick as the bricks themselves; they are 0.98 in on the Basilica of Maxentius, 0.39 to 0.59 in. on the buildings below the Palatine, on the walls of the Baths of Caracalla 0.98 to 1.18 ins for bricks 1.18 ins. thick, as thick as the bricks on the Tor de' Schiavi, on the Palace Emperor in Treves 1.58 ins. for bricks of equal thickness, and thicker than the bricks on the Palace Diocletian in Spalato.

One might say in general, that for concrete walls faced with bricks, the mortar was used in a firm and pasty state and that the joints average as thick as the bricks.

180. Framework. (Half-Timber Work).

Concerning half-timber work, which was built everywhere, Vitruvius wishes that it had never been invented; it causes cracks in the plastering and behaves in a fire "like a torch." Moreover it aids in the more rapid completion of the structure and to the increase of space, since the walls may be made very thin. Blame and praise are here justified. Its employment is furthermore compelled by the fact, that if men wish to introduce a wall in an upper story, to which none corresponds in a lower story. He wishes the substructure for the framework to be raised so high, that the woodwork may not come into contact with the ground. (Vitruvius, Book II, 8). Half-timber walls 9.8 ins. thick with distances of 3.28 ft. between centres of posts of hewn timber, which were 7.1 × 7.1 ins. in cross section, were constructed in a Roman villa near Pola.[168]

Note 168. Compare Schriften der Balkancommission, Antiq. Abth. II. Römische Villa bei Pola. By H. Schwalb. Vienna. 1902. p. 31.

181. Tamped Earth and Wattle-work.

Walls of earth tamped into a form composed of planks on one or both sides were common in Africa and Spain, according to Pliny; like walls of wattle-work coated with clay. (Pliny, Book 35).

If different materials and methods of construction were employed on the same building, Vitruvius prefers for dwellings in

Rome, ashlars for the foundation walls (pilae lapidare), and bricks for the walls of stories (structurae testaceae), with rubble for division and intermediate walls.(parietes caementici).

182. Foundateons.

Firm soil was sought for foundation walls, or if such could not be secured or only obtained with difficulty, they passed to a suitable artificial consolidation of the building site.

The subterranean masonry was required by Vitruvius to be about one-half thicker than that above ground. Foundation piers beneath colonnades were to be connected by arches or to be strengthened by a tamped filling of earth. Piles were employed in soft ground. Vitruvius recommends charred and driven piles of alder or olive wood for use. Whether men used for this purpose the cracked, crooked, relatively very short and also very costly olive wood (some richly bearing trees frequently formed an entire estate) remains doubtful. Massive oaken piles with iron shoes (Fig. 221), such as we still use, have been preserved to us. The spaces between the rammed piles, the author mentioned desires to be filled with charcoal, the masonry above them being constructed with blocks as long as possible and with closely fitted joints, and with interposed masonry. (Vitruvius, Book V, 2).

In the water, wooden caissons (rectangular structures of oaken piles held together by wooden timbers) were lowered into the water, rammed fast, filled with rubble and Puzzolana mortar (2 parts Puzzolana earth and 1 part lime), these then being built upon. (Vitruvius, Book V, 12). When such caissons were not permissible on account of the current of the water, then masonry piers were sunk. The latter had to stand and dry in the air for two months before they were sunk. (Method of building and sinking in Vitruvius, Book V, 12).

For lack of Puzzolana earth, double wooden caissons were sunk, the space between the two walls being filled with clay in baskets of marsh grass. After being thus made tight, the water in the caisson was pumped out and the space within the latter was filled with regular masonry.(Vitruvius, Book V,12).

183. Retaining Walls and Buttresses.

In order to ensure sübstructures, terrace or retaining walls against bending or overthrow, when they had exposed earth ly-

lying behind them, whose weight continually varied, buttresses were employed on the outside of walls. A still remaining example of this kind is the temple terrace of the Olympeion in Athens,[169] completed by the Roman architect Cossutius, another being the temple terrace of Aizani, where the buttresses are connected by arches[170], and especially the high piers of the theatre terrace at Pergamon and also that of the theatre at Aosta, as well as many others.

Note 169. Compare the preceding volume of this Handbook, p. 28. (2 nd edition).

Note 170. Compare the same, p. 192, 193.

Vitruvius requires the buttresses to be at distances equal to the height of the wall and to project at the base as much as the thickness of the wall' the projection should gradually lessen upwards and vanish in the surface of the wall. On the inner side next the masses of earth should be built serrated projections, extending as far as the height of the wall. (Vitruvius, Book VI, 8).

As a means of protection against the pressure of earth filled in against masonry, and also for the purpose of keeping dry the walls standing next the earth, there were built double walls with cross walls between them, against which rested hollow semicylindrical walls, as is the case at the Theatre at Emperor Augustus near Basle. (Fig. 222[171]). A simpler construction is executed at the Amphitheatre at Treves, as well as a more detailed one at the Poikile in Villa Hadrian near Tivoli, where the semicircular apses adjoining the tunnel vaults are covered by quarter spherical vaults. (Fig. 223).

Note 171. Compare Burckhardt-Biedermann, Th. Das Römische Theater zu Augusta Raurica. Mitt. d. Hist. und Antiq. Gesell. zu Basel. 1882.

184. Cost and Value.

As capable of an artistic development, only two kinds of masonry (rubble masonry requires an artificial covering for this purpose) are to be considered:-- the massive or apparently massive ashlar masonry and the massive or apparently massive brick masonry. Both kinds were highly esteemed and equally employed, and the preferred use of either one or the other depended upon local or financial conditions. Building with bricks was cheap-

cheaper, according to the evidence of Pliny. Concerning the aqueduct arches, that the Nicodemians desired to construct, he says in his report to Trajan, some were to be erected with ashlars and others with bricks; for the latter are lighter and cheaper.(Epist. 46).

If brick walls only remained vertical, they were valued at cost price, an evidence of the solidity attributed to them. For rubble stone walls, 1/80 of this cost was deducted for each year of their existence, i.e., their duration was estimated at not over 80 years.

185. Specific Roman Construction.

What masonry construction shall we now designate as specifically Roman, when Roman architects equally mastered all kinds with which we are acquainted today, and to which we have scarcely added a single one?

There could appear to us as new only the masonry of small pieces (concrete masonry) with brick facing; whether the Romans originated this, or whether they merely carried further a method of Africa or Asia Minor no longer found in that locality, we must at once leave unanswered. But the latter is the more probable.

186. Economy in Methods.

"The method of construction is chosen according to the means at command." Erected at one time and with the same materials throughout, we find the more important buildings of the best period in Greece. Men wished to not appear parsimonious in relation to the gods. This excessive care in the execution is more rare in Rome. Men went to work more economically. Costly and unsightly materials are found in use together on the same building, as the means permitted, the construction required, or an intended facing of the work also made possible. Patched construction is naturally not considered here, such as in time occurred in a building and is shown in many structures in Pompeii, for example, -- where by the cutting out of doors and windows, by additions, enlargements, rebuilding of partly destroyed buildings, the most diverse materials occur as if thrown together, just as in the patched work of our own times.

With care and reference to their peculiarities are the different materials employed on the so-called Temple of Vesta in

Rome, for example. The The concealed horizontal foundation walls are coursed in ashlars of peperine, carefully jointed without mortar, while the superstructure consists of hard crystalline limestone. The loaded portions of the uppermost step rest on travertine blocks, while the unloaded intermediate parts are set on peperine. On the softer peperine then succeeds the harder travertine and on this only are the white marble ashlars,from which rise the marble columns.(Fig. 224). We find the same arrangement on the Temple of Faustina. The columns rest upon travertine ashlars inserted in the peperine foundations. On the hard white marble bases stand the monolithic shafts of cippoline, which again bear white marble capitals. The cell wall is constructed of peperine ashlars, which are covered internally by plastering and externally by marble slabs. On the other hand, the architrave, frieze and cornice are again made of hard white marble.

At the Temple of Fortuna Virilis, the substructure and the cell walls, which indeed bore a coating of plaster, are of peperine together with the half columns, while the angle columns of the pseudoperipteral structure and the columns of the portico are of the harder travertine, as well as the bases of all half and entire columns, the capitals and cornices, and the substructure bears a facing of travertine slabs. The header drums of the travertine angle columns extend far into the courses of the peperine masonry. At the Pantheon, the concrete masonry disappeared behind the brick facing and this again behind marble slabs, at least in the portico and the interior. On white marble bases rise shafts of reddish-gray granite and above these are the most splendid Corinthian capitals of white marble, which in turn support a marble entablature.

On the Tabularium, the high substructure and the columns are of peperine, the capitals and the radially jointed architrave being of travertine. We find the lower portions of various city walls to be of hard limestone, where exposed to the battering ram, while the higher parts are constructed of softer tufa or of bricks.

Everywhere is the more economical and correct use of building materials. Only Syrian structures exhibit the Greco-Egyptian careful method of construction without regard to cost.

187. External Plastering.

Decorative and protective coatings were applied to walls of small materials by the previously mentioned facing with slabs of hard and costly kinds of stone or by the cheaper and yet durable plastering. It was laid on the rough coating in three coats of mortar with fine sand and in three layers of marble chips (coarse, medium and fine powdered) forming a thickness of 2.75 to 3.15 ins. Plastering from 1.58 to 1.97 ins. thick is rare. Thinly applied plastering easily cracks and does not receive the necessary polish.

Examples of coatings of plaster -- of external and internal wall plastering on masonry and half-timber walls -- are given by Fig. 225.[172]

Note 172. According to Schwalb's finds in the Villa near Pola. See the book mentioned in footnote 168, p. 35, 36.

Coats of color applied to this wet marble plastering acquired a dazzling polish and lasted as long as the plastering itself.

For the construction of cornices, which must be made light and graceful in the interior, Vitruvius requires marble dust without the addition of gypsum. On account of keeping it clean, it needs to be smooth in rooms. Even ashlars are artificially formed in plastering and their joints are then usually richly ornamented.(Fig. 226).

For plastering on half-timber work, the wooden timbers were not alone covered by reeds, as with us, but crosswise reeding was required over the entire surface; "these crossed and doubled reeds extending over the whole surface prevent crumbling and loosening." (Vitruvius. Book VII, 3).

If recent writers decide "that the antique plastering substantially contributed to the durability of the walls", then must it be bad for the walls themselves, in comparison with many modern papered rooms, that are plastered, if the paper must hold this in place!

188. Walls protecting against Dampness.

In order to keep dampness from walls or as a protection against damp walls, there were employed tiles with projections as shown in Fig. 194, as such were found in the baths of Pompeii or also around the channel of the splendid fountain of

the Villa in Euren.[173]

Note 173. Compare Wilmowsky. Archaeologische Funde in Euren. 1859. Treves. Plate 5.

The building of a second thin wall at a little distance from the damp one as a means of keeping out its dampness, or a facing of this with hollow tiles coated with pitch, etc., is recommended by Vitruvius, who minutely describes this procedure in Book VII, 4.

189. Quantities.

The completed work was paid for according to quantities. Pliny (Epist. 28) desires an architect at Prusia; "for in his opinion, if conscientiously remeasured, no inconsiderable sums might be demanded back from the building contractors." Trajan had none at command and wrote to the petitioner (Epist. 29); "Such are found in every province, who may be trusted."

The letter (Epist. 48) concerning the building of the Theatre at Nicea shows that under some circumstances, there might be found something human in the mechanics at that time, just as the ancient proverb avers concerning the decision of an expert there mentioned. (See text for greek proverb).

190. Free Pillars and Stone Beams.

The method of construction for free pillars, columns and piers of stone depended in a greater degree on the quality of the material and the load applied to it, than for space-enclosing walls supporting beams.

Hard and resistant materials permitted under like conditions of loading greater weights for smaller diameters or monolithic construction of the columns, while a softer, lighter, more easily crushed material required stumpy and coursed pillars. The soft and porous tufa or peperine permitted no proportions, like those of crystalline limestone, of porphyry or of granite. Compare the many tufa pillars of the ancient temples used under similar conditions with the lighter ones of the later period, of strong marble or of still stronger granite.

The tufa actually earliest employed in the country compelled the columns to be built of separate blocks; like the walls, the shafts of the columns were likewise in courses. Strong limestone, travertine, permitted free play, and the crystalline limestone, granite and porphyry allowed the use of monoliths of

not too great diameters. For very large dimensions or when transportation and erection presented special difficulties, men continued the use of separate blocks, even with the use of the last mentioned materials.

The Grecian system was employed in the jointing, as the very carefully executed so-called Temple of Vesta in Rome still exhibits today. The same cutting away at the middle, the same connections by dowells with channels for pouring in the lead, the same rubbing of the surfaces in contact is here found, as that exhibited in the Ionic and Corinthian orders of the Greeks. 174 But the pouring channels have semicircular and rectangular sections, while the triangular is preferred on Grecian monuments. The entire surface was generally wrought uniformly without a rubbed border, when three dowells, set quite at random, were employed as a fastening. (Fig. 227).

174. See the preceding volume of this Handbook, 2 nd edit. p. 174, 199.

In opposition to the usual Grecian custom, which moreover also has its exceptions, the columns at the so-called Temple of Vesta do not stand free on the stylobate, but they are connected with the upper step by dowells. The drums are not of uniform size on the different columns, for some columns are composed of 6 blocks, including capital and base, others having 12 pieces. How firmly these drums hold together when constructed with dowells is shown by such a one in Baalbek, that was thrown against the cell wall of the Temple. Instead of opening at the joints, this indented the ashlars of the said wall in falling, and the remain unchanged at the surfaces of the joints, as if originally constructed of a single block, although leaning obliquely.

Not invariably was the same material employed for a column. When a coating of stucco was applied, for example, then tufa and travertine frequently alternate at certain parts; even for hard stone occurs a change in the materials, then certainly more for esthetic reasons, for example, when the bases are made of white marble, the shafts of porphyry, granite, or of variegated marble, the capitals again being of white marble.

Besides the monoliths or the columns composed of dressed blocks and drums, there were also columns built of brick com-

combined with dressed stones, both on public (Amphitheatre Castranse and imperial palaces in Rome, Basilica in Pompeii) and also on private buildings. For these were specially moulded bricks employed, of frequently complex form, or the ordinary triangular facing bricks were used for producing a circular external surface, while the nucleus was composed of larger and smaller fragments of bricks; when shaped bricks were used, this nucleus consisted in the different courses of circular or polygonal tiles of different diameters, adjoining which were then the radial bricks. A proper bonding and alternation of the edge joints is carried out in all the courses.

We likewise frequently find the lowest drum resting on the ground to be made of a block of hard stone, above it being erected the coursed masonry of alternately tufa and brickwork. (Fig. 228).

Columns of small diameter (0.85 ft.) and of less careful construction of cut bricks and stone spalls between them are preserved in Villa Hadrian near Tivoli (Fig. 229); others similarly constructed are in the so-called Stadium of the Palace of the emperor on the Palatine; (Fig. 230); except that there the nucleus is covered with a costly red Porta Santa marble and the bases with white marble. The narrow strips of the marble covering are fastened together and to the nucleus by bronze pins. (Fig. 230).

Columns made of bricks were mostly coated with plastering. But there may be mentioned as perfected and beautiful works of brick masonry the half columns on the Amphitheatre Castrense in Rome and the octagonal piers at the so-called Temple of Deus Rediculus there.

Gilded and fluted shafts of columns of bronze, fragments of hollow bronze columns were found in due time in the vicinity of the Lateran and in the Theatre of Aventicum.[175]

Note 175. Compare Normand, Ch. Essai sur l'Existance d' une Architecture metallique or Role du Metal dans les Constructions Antiques. Ency. d'Arch. 1883. p. 71.

191. Bases of Columns.

The bases of columns are mostly made of a single block and give the line for setting the shaft' they are also frequently wrought together with the lowest drum. For brick columns,

they are either composed of shaped bricks of the same material or of ordinary bricks, and they form the support of the shaft. (Compare a in Fig. 231). Hollowed out carefully according to the shape of the column and set on the shaft in pieces are the white marble bases of the masonry on the Palatine (Fig. 230).

192. Capitals of Columns.

The capitals were monoliths or were constructed in courses and they received above the abacus a protecting fillet, after the Greek fashion, which was frequently even 1.18 ins. high. (Temple Magna Mater at Rome and Triumphal Arch of Augustus at Aosta exhibit capitals built in courses).

In brick structures, the height of the capital is divided into as many courses, as those shown by the adjacent masonry; but it is then to be assumed, that the courses composing the capital are specially moulded and burned, and that they are not carved from the ordinary solid bricks after burning.

By the last is lost the advantage of terra cotta, that of easy duplication of ornaments, and there must be accepted in exchange bad execution and great expenditure of time and money. (Compare the execution on Sedia del Diavolo, on the so-called Temple Deus Rediculus (Tomb befor Gate S. Sebastiano) and on Amphitheatre Castrense in Rome).

By the aid of ordinary and shaped bricks is constructed the base of a pilaster on a tomb near the Appian Way, in Fig. 231 a; in Fig. 231 c is the covering of the tympanum of the so-called Sedia del Diavolo, of yellow tiles enclosed by narrow red courses; also part of a voussoir arch from Gate Pretoria in Turin -- brick construction of faultless character. (Fig. 231 b).

Bronze capitals in the interior of the Pantheon were mentioned by Pliny; at the great Temple in Gerasa were found the stone cores of bronze capitals, and at the Temple in Palmyra, such are still found on the shafts of the columns, which exhibit arrangements for receiving the metal covering.(Fig. 232). In the Museum at Lausanne is preserved a bronze capital 4.7 ins. high, resembling the Corinthian of the period of decadence.

193. Piers.

Piers were of stone or bricks, made sometimes square, sometimes rectangular or even octagonal in cross section; for the

larger dimensions, pilasters, half or three-quarter columns are frequently connected with them, i.e., wrought in the same block.

Large cross sections required the making of a course in several blocks, which were then carefully fitted together at the abutting surfaces and were connected by iron cramps, with the proper alternation of the joints.(Fig. 283). Half octagonal piers executed in brickwork in the best manner, coursed like the enclosing masonry, are preserved in the frequently mentioned Tomb before Gate S. Sebastian in Rome.

194. Architrave.

On columns and piers rest the horizontal beams (architrave) with the fragments of the cornice and walls lying above them, or arches spanning from one support to another, which receive and transmit to them the loads.

Openings in the walls, doors, windows or niches, were covered and enclosed in like manner by stone lintels or arches. The resistance of the material to breaking fixed the distance between the supports and the possibility of a definite free length of the architrave. Close or open spacing primarily depends upon it. Wooden architraves permit the latter, stone architraves require the former. Strong kinds of stone admit of greater free length of architrave than the open and porous stone.

When columns were to be widely spaced with a material of no great strength and quarried in pieces not sufficiently long, recourse was had to special methods of constructing architraves. If these were composed of sedimentary stones, their strength could be somewhat increased by setting them on edge, and the more so if architrave and frieze were wrought from a single block, whereby might be obtained a more favorable proportion of the length to the height of the block. For stone quarried in small blocks, it was better to make the architrave of several voussoir-shaped stones, i.e., by the introduction of the straight arch instead of an architrave of a single piece.

These horizontal arches were constructed of 3, 5 , 7 and 11 stones (including abutment blocks), openings up to 16.4 ft. being spanned thereby. For example in Pompeii, for an inter-

[illegible]

[illegible] varies between [illegible] of the [illegible]. By the use of inductive [illegible] seemed to improve the static conditions [illegible] considerably [illegible]

[illegible]

[illegible] of an [illegible] the architectural [illegible] in Syracuse.(Fig. 237).

[illegible] Figs. [illegible] is [illegible]

[illegible] (Fig. [illegible]) [illegible] the so-called [illegible]

intercolumniation of 8 ft, three blocks were employed, which are cut in the same pieces with the frieze; at the Theatre in Ferenti, we find openings of 7.55 and 10.3 ft. in the clear; at the Amphitheatre in Verona, those of 8.5 and 11.15 ft.; at the Theatre in Orange, openings of 15.9 ft. are spanned by straight arches.(Figs. 234, 235, 236).

The height of the arch voussoirs varies between 1/3 and 1/4 of the clear width of the opening. By the use of indented ashlars, it was sought to improve the simple construction earlier common for the certainly considerable span of nearly 16.4 ft.(Fig. 236). If large masses of masonry rose above these straight arches, they were then relieved by semicircular arches turned above them.(compare Orange and Ferenti). The horizontal arch then formed the desired shape at top and only had to support the masonry filling below the semicircular arch. (Figs. 234, 236).

An exception is formed by a straight arch of the Amphitheatre in Verona, which has a span of 11.2 ft. and receives heavy masonry besides a tunnel vault 10.8 ft. wide. Mortar was as rarely employed in all these straight arches as in the Etruscan or other antique ashlar arches.

By bonding the springing stones into the coursed masonry and the insertion of an indented ashlar, the architect assisted the construction of a straight lintel of a doorway at the Amphitheatre in Syracuse.(Fig. 237).

A complex construction is executed in Villa Hadrian near Tivoli,according to Figs. 238, 239. It was there desired to produce a rather beautiful and suitable appearance with small stones and little means. In a rather childish manner, the springing blocks were cut with triple surfaces, set on a marble slab and the closing piece inserted, the face with the architrave and the triglyph-frieze being covered by thin marble slabs and well plastered on the inner side. In like manner was also constructed the cornice over the great circular portico of the Theatre Maratimo; excepting that the springing surfaces there have grooves (Fig. 240) in order to prevent as far as possible the slipping of the voussoirs.The construction of a doorway lintel is capricious at the so-called Temple Esculapius at Spalato, where one-half the springing surface is vertical

[illegible] and the [illegible] is [illegible] at [illegible]°, [illegible] [illegible] [illegible] in [illegible] (Fig. 24?).

[illegible] (Fig. [illegible]), the [illegible] [illegible] are brought in one piece, on which is laid [illegible] slab, and which alone is not supposed to bear the [illegible] [illegible]. [illegible] from [illegible] arises some [illegible] [illegible] the [illegible], corresponding to the [illegible] [illegible], which [illegible] the mastery of the [illegible], an [illegible] of the [illegible] [illegible] [illegible], [illegible] they [illegible] [illegible] [illegible] columns (?). The [illegible] [illegible] [illegible] [illegible] have a [illegible]; [illegible] other ones [illegible] [illegible] [illegible].

[illegible] [illegible] case of [illegible] [illegible] something was also expected [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] the [illegible] [illegible] [illegible] and the [illegible] [illegible] [illegible], and [illegible] has a total length of 13.4 ft., a [illegible] [illegible] [illegible] [illegible] ft., and [illegible] 2.38 ft. [illegible] [illegible] 1.57 ft. [illegible]. By the use of a [illegible] [illegible] [illegible] [illegible] [illegible], the [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible], but not exceeded them, as [illegible] [illegible] [illegible] [illegible].

[illegible] [illegible] [illegible]

[illegible] [illegible] and [illegible], [illegible] Rome	[illegible]
[illegible] [illegible] [illegible]	26.9 ft.
[illegible] [illegible] [illegible], [illegible]	13.4 ft.
[illegible] of [illegible], [illegible]	[illegible].6 ft.
[illegible] [illegible] [illegible]	1[illegible].4 ft.
[illegible] [illegible] [illegible] [illegible], [illegible] [illegible]	[illegible].9 ft.
[illegible] [illegible] [illegible], [illegible] [illegible]	15.[illegible] ft.
[illegible] [illegible] [illegible], [illegible] [illegible]	15.[illegible] ft.

The [illegible] [illegible] [illegible] [illegible] [illegible], when the [illegible] was [illegible] [illegible] [illegible] [illegible], as on [illegible] [illegible] [illegible] [illegible] by [illegible] [illegible] and [illegible] [illegible]. It was composed of small blocks with vertical and [illegible] [illegible] [illegible] [illegible] [illegible], as [illegible] [illegible] [illegible] [illegible] [illegible], and this was [illegible] [illegible], the [illegible] [illegible] of the [illegible] on the [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] from the wall.

[illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]

vertical and the other half is cut at 45°, the two doorway jambs corresponding to this arrangement.(Fig. 241).

On Temple Concordia at Rome (Fig. 242), the architectrave and frieze are wrought in one piece, on which is laid the cornice slab, and which alone is not supposed to bear the weight of the tympanum. Therefore flat relieving arches were arranged above the cornices, corresponding to the intercolumniations, which should receive the masonry of the pediment, an arrangement of the latest restoration indeed, that may form an excuse for the inverted columns.(?). The middle relieving arch might in any event have a purpose; the outer ones certainly could have none.

That in case of good material something was also expected from the horizontal stone lintel is shown among others by a lintel in the Amphitheatre at Verona, loaded by two vaults and the masonry above them, and which has a total length of 13.4 ft., a free length of 9.0 ft., and is 2.36 ft. high and 1.97 ft. wide. By the use of crystalline limestone were generally secured the structural results deduced from the well known Grecian temples, but not excelling them, as shown by the data subjoined.

Lengths of Architraves.

Temple Antoninus and Faustina in Rome	13.1 ft.
Temple Roma and Venus	20.3 ft.
Portico of Pantheon, front.	16.4 ft.
Portico of Pantheon, side	14.6 ft.
Temple Mars Ultor	16.4 ft.
Temple Great at Baalbec, middle intercolumn.	20.9 ft.
Temple Great at Baalbec, side intercolumniat.	15.0 ft.
Temple Helios at Baalbec, middle intercolum-	18.1 ft.

The construction was substantially simplified, when the architrave was merely decorative on buildings, as on wall surfaces ornamented by projecting half and three-quarter columns. It was composed of small blocks with vertical end joints or was unnecessarily cut in voussoirs, as for the pure straight arched architraves, and this was less necessary, the greater the bearing of the voussoirs on the wall and the less their projection from the wall.

The older Roman structures (Tabularium, Temple Fortuna Vir-

Virilis) generally exhibit the radial jointing for architraves built into walls; later appear the vertical joints with less care and more correctly (Colosseum); besides the blocks with vertical joints, others again have a voussoir middle block, that unnecessarily rests on a projecting massive keystone of a semicircular arch,(Compare Arch of Septimus Severus and Arch of Janus), while the latest period returns again to the ancient system, as shown by Gate Nigra in Treves (Fig. 243).

195. Brick Architrave.

The architrave and the straight lintel were constructed of bricks, both free-spanning and corbelled. In the first case was employed the arch set with mortar not too thin, which for heavy loading was strengthened by a segmental arch turned above it (Colosseum), or a semicircular arch took the entire load from it (Basilica Maxentius, Fig. 244). On the exterior of Amphitheatre Castrense in Rome, the architrave projects 0.82 ft. and was composed of 6 courses of bricks, the lowest of which consisted of tiles 1.97 ft. square, half buried in the wall, to which succeed 4 courses of common bricks and a moulded covering course (Fig. 259).

But the segmental must replace the straight lintel by its actual form, and it then occurs as an architectural shape on the building, as shown by secular structures in Ostia (Figs. 245, 246).

Between the straight and arched covering of openings in walls must be included those made of bricks and rising in the form of a gable, like those executed for the blind niches of the Theatre in Taormina. Two straight arches of slight inclination rest against each other and thus cover the niche 3.5 ft. wide and 1.77 ft. deep (Fig. 247).

196. Arches.

The width for connecting detached supports by an architrave was limited as shown. The limits were extended as soon as the horizontal spanning of the openings and connecting the free supports gave place to the arched form. With the latter also became possible the very great or aerostyle spacing of Vitruvius, without abandoning stone and having recourse to "continuous wooden" beams; by using the arch, the widest monumental spans could be executed with the smallest dressed ashlars.

[illegible] forms of [illegible], the [illegible] were [illegible] and [illegible].

It was [illegible] of [illegible] number of voussoirs (5, 6, 7, 9, 11, 15, 17 --), of which the springing stones next the imposts [illegible] were usually of larger dimensions and were also frequently marked by special decoration. The voussoirs [illegible] and [illegible] are carefully [illegible] on the [illegible] surfaces [illegible] arch. They were often protected from slipping by iron cramps or [illegible] Roman [illegible] Porta [illegible]; Col-[illegible] in Fig. 2[illegible]. The surfaces of the faces and soffits [illegible] without [illegible] and [illegible], [illegible] they were [illegible] and covered by [illegible]. If the [illegible] of [illegible] for a [illegible], a [illegible] of [illegible] of wood and stone [illegible] the [illegible] of the arch, [illegible] the usual custom [illegible]. In [illegible] more [illegible], [illegible] the [illegible] as far as possible, [illegible] arch, [illegible] the [illegible] of the arch, [illegible] which [illegible] a more [illegible] horizontal [illegible] of the [illegible]. [illegible] the [illegible] the principle of [illegible], and they [illegible] from the [illegible] of the [illegible] of [illegible] (Fig. 249).

[illegible] it was [illegible] to combine the radial joints of the [illegible] and [illegible] joints of the [illegible] of the [illegible], [illegible] the [illegible] on the [illegible] of the [illegible] of the arch. [illegible], [illegible] of the [illegible] of the [illegible], which was not liked. Therefore [illegible] the [illegible] works, [illegible] joints were [illegible] to [illegible] such as [illegible], [illegible] of [illegible] were [illegible] by [illegible]. It [illegible], [illegible] the [illegible] joints [illegible] of the [illegible].

Among the known forms of arches, the semicircular arch was most employed, and it first received a formal development.

It was constructed of an uneven number of voussoirs (3, 5, 7, 9, 11, 15, 19 - -), of which the springing stones next the imposts and the keystone were usually of larger dimensions and were also frequently marked by special decorations. The voussoirs were set without mortar and were as carefully dressed on their contact surfaces as for the straight arch. They were often prevented from slipping by iron cramps or pins or by indenting the stones (Compare Amphitheatre at Treves; Colosseum in Fig. 248). The surfaces of the faces and soffits either remain without marginal drafts and with rough bosses, or they were moulded and covered by ornaments. If the joints of the voussoirs radiated from a centre, a centering of wood or of wood and stone was necessary for the erection of the arch, like the usual custom in Italy today. In countries poor in wood and especially in the later period, men sought to make the centering unnecessary as far as possible, by peculiarities in the construction of the arch, when the joints did not pass through the centre of the arch, but special centres were assumed for them, which permitted a more nearly horizontal position of the joints. Men again approximated for the lowest voussoirs to the principle of corbelling, and they formed only the keystone with joints radiating from the centre of the arch, as executed on the great Gateway Arch of the street of colonnades in Palmyra (Fig. 249).

If it was desired to combine the radial joints of the voussoirs with the straight bed joints of the coursed stones of the masonry, the latter must meet the former on the outer line of the enclosure of the arch. But for voussoirs of equal dimensions, this resulted in a reduction of the height of the horizontal courses, which was not liked. Therefore on the earlier works, the horizontal joints were allowed to intersect the arch at random, producing adjacent stones of triangular and of trapezoidal form, that were executed according to circumstances and were easily injured in setting on the points, or were crushed afterwards. It the arches were enclosed by pilasters, columns or architraves, then the radial joints were extended over the enclosure of the arch accordingly. If too large blocks resulted, the rectangular stones were reduced to

[illegible]

[illegible] of the horizontal [illegible] a well- [illegible] to-day [illegible].

In the [illegible] of the late period [illegible], [illegible] believed that they had found the [illegible] for the [illegible] of the voussoirs [illegible]. [illegible] in the [illegible] of [illegible] without [illegible], and they [illegible], that they are difficult to cut and hard to set. They [illegible] on two sides, in the direction of the line of [illegible], and [illegible] vertically next the [illegible]. [illegible] as well as [illegible], where they were used.

Good pointing of the stone is found on the arches of the [illegible], on the [illegible] of [illegible] and of [illegible], at the [illegible] of [illegible], [illegible] less [illegible] and [illegible] of [illegible] on the [illegible].

An [illegible] of voussoirs with the keystone, [illegible] the [illegible] arches, is [illegible] on the [illegible] in Orange, [illegible].

For the pointing at the intersection of the arches, the necessary information is afforded by the [illegible] (Fig. 151), [illegible] (Fig. [illegible]) [illegible] as different results.

[illegible]

[illegible], [illegible] of [illegible] or of [illegible], [illegible] before the [illegible].

[illegible] examples of [illegible] in the [illegible] in S. Barbara at [illegible] and in [illegible]. [illegible]

1 [illegible]

resulted, the rectangular stones were reduced to pentagonal form by vertical equalizing, thus further receiving a good bearing of the horizontal ashlars against the voussoirs, a method that remains in use today (Fig. 250).

In the indented ashlars of the late period (Palmyra), men indeed believed that they had found the best solution for the connection of the voussoirs with coursed ashlars. They aided substantially in Palmyra in the erection of the arch as far as the keystone entirely without centering, but they have the disadvantage, that they are difficult to cut and hard to set. They must fit on two sides, in the direction of the line of the arch, and then vertically next the coursed stones. Therefore we generally find them broken, especially if the horizontal portion was made rather long (Compare Palmyra as well as later buildings, where they were used).

Good jointing of the stone is found on the arches of the Colosseum, on the Triumphal Arches of Septimus Severus and of Titus, on the Mausoleum of Hadrian, and on Gate Maggiore in Rome; (Fig. 250); less beautiful and advisable is that on the Arch of Janus and on the Arches in Ferenti and Verona.

An increased depth of voussoirs next the keystone, not unlike the so-called Florentine arches, is executed on the Triumphal Arch in Orange, where this is not made prominent.

For the jointing at the intersection of two arches, the necessary information is afforded by the arcades of the Amphitheatre in Ferenti (Fig. 151), for that of the meeting of three arches on a pier, Fig. 252, and Fig. 253 for the same with two arches having springings at different heights.

197. Mixed and Brick Arches.

Besides ashlar arches, those of rubble and of bricks were in use, or of both materials combined, to which are added those of bricks and concrete masonry.

Well preserved examples of such mixed construction remain to us in the Cathedral and in S. Barbara at Treves and in Villa Hadria near Tivoli, among others. On the latter building alternate two cut tufa ashlars with a brick, but in Treves two courses of bricks very regularly alternate with one of limestone, also a brick with a limestone ashlar (Figs. 254, 255).

A peculiar construction with brick arches above each other

[illegible] in the [illegible] of [illegible] is [illegible], which re- [illegible] a similar [illegible] in the [illegible] of the [illegible] of Diocletian [illegible]. [illegible] contains [illegible], [illegible] are made of no less than [illegible] concentric rings of masonry, each [illegible]

[illegible]

[illegible] are [illegible] stones, that are connected through the arch by large flat [illegible]. The interstices of this [illegible] filled with concrete. [illegible] is a [illegible] in [illegible], [illegible] is required; however the arch is lighter in weight and [illegible] of [illegible]. It is self-evident that these [illegible] must be [illegible] to a centre [illegible] and must belong to a [illegible] in Rome; Fig. [illegible].

In order to avoid [illegible] stone [illegible] on the use of wedge-shaped [illegible], a method of construction of arches was [illegible], in which [illegible] and [illegible] (Figs. [illegible]).

[illegible] — or [illegible] a [illegible] more [illegible].

[illegible]. Friezes.

In [illegible] structures, the frieze [illegible] are usually [illegible] from one block ([illegible] Antonine, [illegible], [illegible] of Pantheon in Rome, Temples in [illegible], with [illegible] and [illegible], [illegible] in [illegible] or [illegible]; [illegible] from the same [illegible] of [illegible] of the [illegible]. [illegible], [illegible] Virgil's [illegible].

For brick buildings, [illegible] consists of [illegible] as [illegible] in the [illegible] of [illegible]. [illegible] in Rome, [illegible].

[illegible]. [illegible].

The [illegible] cornice with its lower [illegible] are [illegible] from one block, [illegible] we [illegible] it in courses for very [illegible]. [illegible] the cornice of the [illegible]

is found in the masonry of Palace Imperial in Treves, which recalls a similar caprice in the dome of the Tomb of Diocletian at Spalato. Over openings 3.02 ft. wide in the walls are turned no less than 5 concentric rings of masonry, each separated from the next by a bric course (Fig. 255). Arches constructed of brick and concrete masonry are mostly faced with bricks on both sides, that are connected through the arch by large flat tiles. The interspaces of this arch skeleton are filled with concrete. Thereby is a saving made in bricks, but more lime mortar is required; however the arch is lighter in weight than one entirely of bricks. It is self-evident that these arches must be turned on a centering and must harden to a certain degree thereon.(Compare Palace Emperors in Rome; Fig. 256).

In order to avoid chinking with stone spalls or the use of wedge-shaped bricks, a method of construction of arches was chosen, in which were employed normal bricks and cut stone voussoirs (Fig. 257).

The arch as merely a piece of decoration and cut in masonry dressed in rectangular form, occurs on the facade of the Theatre in Orange (Fig. 258), -- an arrangement as senseless as the horizontal arch above horizontally coursed masonry.

198. Frieze.

In ashlar structures, the frieze and architrave are usually wrought from one block (Temple Antonine, Temple Saturn, Arch of Goldsmiths, Portico of Pantheon in Rome, Temples in Cori and Pompeii), with vertical and with inclined joints, whether the architrave is freely supported or corbelled; but we likewise find the same constructed of separate pieces, that were laid on the architrave after the Grecian manner. (Arch of Constantine, Temple Fortuna Virilis in Rome).

For brick buildings, it was composed of courses of the same bricks as employed in the masonry of the enclosing walls. (Temple Deus Rediculus, Amphitheatre Castrense in Rome, Fig. 259).

199. Main Cornice.

The main cornice with its lower members and the crowning cyma was generally wrought from one block, when marble was employed; we also find it in courses for very great or medium dimensions. Thus the main cornice on the Temple Antonine in

[illegible], of [illegible] and [illegible] [illegible], [illegible] of a [illegible] in [illegible]. In the [illegible] of [illegible], [illegible], and the [illegible] of [illegible] [illegible] of a single [illegible]. [illegible], prices and [illegible] cut [illegible]. [illegible] of the [illegible], the [illegible] of a [illegible] in [illegible].

[illegible] and [illegible] the [illegible] the entire structural and formal equipment of Grecian architecture became [illegible]. The [illegible] and almost [illegible] [illegible] in [illegible] [illegible] of [illegible] gave place [illegible], in spite of its [illegible]. The [illegible] of [illegible] employed was [illegible] for great blocks [illegible] for [illegible], which [illegible] the [illegible] of [illegible] on the [illegible] used in [illegible]; the [illegible], since the [illegible] had [illegible] joints [illegible].

[illegible] of [illegible], [illegible] [illegible] of [illegible] [illegible] [illegible] in Rome, [illegible] [illegible] of [illegible], [illegible] [illegible], [illegible] of the [illegible]. The [illegible] difficulty [illegible] of the [illegible] of the [illegible] and of the [illegible] of the [illegible]. The height of the [illegible] cornice [illegible] generally [illegible] to the [illegible], [illegible] the [illegible] is only [illegible] of the height. (Compare [illegible] in Rome, with cornice in Fig. [illegible]).

[illegible]. [illegible] Cornice.

The [illegible] cornice was [illegible] part [illegible] [illegible]. The [illegible] [illegible] and [illegible] [illegible] around it [illegible] [illegible] [illegible] the [illegible] of the [illegible], [illegible]. [illegible] [illegible] [illegible] [illegible], [illegible]. [illegible] block of the [illegible] [illegible] cornice [illegible] [illegible], [illegible], of [illegible] [illegible], was [illegible] placed [illegible] [illegible].

Rome, composed of cyma, geison and doubled bed-mouldings, consists of a single block in height. On the Arch of Septimus Severus, the architrave, frieze, and the lower portion of the cornice as far as the dentils is constructed of a single block, while the dentils, ogee, geison and cyma are again cut from one block. On the portico of the Pantheon at Rome, the great modillion cornice consists of a single block in height.

The endeavor to cut and set with the largest possible blocks the entire structural and formal equipment of Grecian architecture became everywhere apparent. The little and almost childish coursing in certain portions of Grecian structures gave place to one more economical, in spite of its massiveness. The quantity of material employed was less for great blocks that for numerous smaller ones, which required the addition of the inch for dressing or the circumscribing prism in quarrying; the labor was lessened, since the numerous bed and end joints vanished.

For buildings of ordinary brickwork, the cornice was constructed of projecting common bricks with the addition of simple moulded ones (Amphitheatre Castrense in Rome), or richly ornamented corbel bricks of special form, intermediate pieces, etc. were employed, which repeated the forms of the cut stone cornice of moderate projection. The structural difference then chiefly consisted of the smallness of the elements and of the slight magnitude of the projection. The height of the stone cornice is generally equal to the projection, but for brick cornices, the projection is only 2/3 of the height.(Compare Temple Deus Rediculus in Rome, main cornice in Fig. 259).

200. Pediment Cornice.

The pediment cornice was in great part constructed after Grecian models. The latter indeed did not agree with each other; but they substantially accord in having the pediment cornice cut like the horizontal drip cornice and laid on the inclined wall of the tympanum, where it was ensured against slipping by dowells. This jointing cannot be considered as particularly appropriate,for without fastening it by dowells, the cornice blocks would slide. A great starting block of the pediment, that was composed of the horizontal drip cornice and the inclined pediment cornice, i.e., of these parts combined in one block, was frequently placed as a counterweight (Akragas, etc.); agai

[illegible]

[illegible] that the principal arches [illegible]. In this [illegible] the [illegible] and the [illegible] have been [illegible], this method could then be [illegible]. [illegible] employed in the [illegible] at [illegible]. The general construction of buildings [illegible] of [illegible], [illegible] excellent [illegible] and [illegible] was employed in the little [illegible], [illegible] (Fig. [illegible]).

[illegible] of [illegible] Temple [illegible] are on the [illegible] is [illegible] the [illegible] [illegible] to be [illegible].

[illegible] of the [illegible] of the [illegible], [illegible] next the [illegible] by the use of [illegible]. In [illegible], [illegible] of the [illegible] was [illegible] being [illegible] Fig. [illegible].

[illegible] the [illegible] at right angles [illegible] (Fig. [illegible]).

against these might rest the inclined cornice blocks. If this starting block were dowelled fast to the frieze and the frieze blocks were held together by cramps, this method could then be accepted. We find it employed on the Ionic Temple at Theltbata in the Lebanon. The better construction of building the pediment cornice of indented ashlars, that had an excellent hold without metal cramps, and which was employed in the little Temple in paestum, found little or no imitation (Fig. 260).

On the pediment of the little Temple in Palmyra and on the pantheon in Rome is retained the indeed very economical but scarcely to be recommended Grecian jointing.

On the horizontally coursed ashlars of the tympanum of the Pantheon, their weak and acute angles next the pediment cornice are avoided by the use of indented ashlars. In Cori, under the junction of the pediment cornices was set stone piers extending through the pediment wall, the intervals being filled with light masonry in mortar (opus incertum; Fig. 260). on the Maison Carree (Temple Augustus) at Nimes, the end joints of the pediment cornice are cut at right angles to the architrave (Fig. 261).

Chapter 5. Beam Ceilings and Vaults.

a. Ceilings of Wooden or Stone Beams or Stone Slabs.

201. Wooden ceilings.

The ceilings in dwellings and likewise in public buildings, where it was necessary to cover large rooms in an inexpensive manner, were made of wood, in the same way that is still in part common in Italy. The beams were hewn or dressed and remained visible as ceiling beams; they were covered on top by beams, boards or paving, and they served as the framework or support of the floor. The horizontal ceilings with coffers for rooms are proved by Vitruvius (Book VII, 2). The upper surface of the wood was protected by paint or by coverings of boards, metal, and terra cotta, or for more richly decorated rooms, the woodwork served as a core for these more costly materials.

Painted terra cotta cases from Sicily and lower Italy, that are indeed to be referred to Grecian buildings, give us information concerning this kind of covering. What prevailed in Magna Grecia was likewise common at the same time, at least in southern Italy. The method of fastening it to the woodwork is shown by the finds at Metapontum.

The clay cases preserved in the Museum there in great numbers, are 13 ins. high, decorated by reliefs and painted, and they exhibit square holes in their sides, through which copper nails were driven into the woodwork thus covered, and which partly bent still remain in the holes. These nails are all 5.1 ins. long, square with square heads, and they accurately fit the holes in the clay cases. The metal, its form and size, leaves clear from all doubt its former fastening in wood; likewise the fact that the terra cottas nowhere show vestiges of mortar on the back, but only the very clean clay surfaces, proves that they were only employed over wood. Pieces in the Museums at Syracuse, Palermo, Selinus and Castelvetrano exhibit similar arrangements for fixing and the same lack of vestiges of mortar.

Since some pieces are entirely flat and have no added mouldings, these may have served as plain centre pieces between two cases. But on the contrary, others show added mouldings and conical or cylindrical holes, both on the painted as well as on the unpainted flange.[176] If these pieces did not serve

[illegible] which groups [illegible] all gutters as [illegible],
at least in one [illegible] shown [illegible] the [illegible] of Selinus and on the Treasury of [illegible] in Olympia, it instead requires no [illegible].

Note 176. See the preceding volume of this Handbook (2 nd [illegible]) Vol. 9, [illegible] 180.

[illegible]. Wood Beam Ceilings.

Stone beams were replaced in time, as for the ceilings of [illegible] of the [illegible], [illegible] by the [illegible] the [illegible], and this change of material likewise occurred in the [illegible] of [illegible] forms of [illegible], [illegible] to the [illegible].

[illegible]. Stone Slab Ceilings.

[illegible]. Stone Slab Ceilings.

The [illegible] of [illegible] stone [illegible] construction, [illegible] to [illegible] covered with coffered slabs, as [illegible] on the Parthenon and the Erectheion at Athens.

[illegible] of horizontal stone slabs in the simplest form, [illegible] covering arches were dressed smooth above and beneath, are found in the lower gallery of the [illegible] at Arles. [illegible], 1.[illegible] ft. [illegible] [illegible], forming both the floor of the upper, and the ceiling of the lower gallery (Fig. 2[illegible]). In order to [illegible] of the [illegible] within [illegible] limits, the construction of vaults is here avoided, though found everywhere in [illegible]. The same reason must likewise have produced the same [illegible] at the Amphitheatre [illegible].

In order to [illegible] four [illegible], it was also [illegible] the [illegible] of [illegible] (Circus at [illegible]), [illegible] a story 28.[illegible] ft. [illegible] an obelisk [illegible] ft. high, now called a "[illegible]". The [illegible] of this [illegible] is first enclosed by a series of stone beams, thus [illegible] [illegible] a [illegible], and upon this rest smaller ceiling beams, [illegible] covering of the [illegible]. The [illegible] is built [illegible]; [illegible] over the space has no [illegible], except [illegible] own weight.

If these pieces did not serve as coverings of stone cornices, at least in the manner shown for the Temples at Selinus and on the Treasury of the Geloans in Olympia, it indeed requires no special proof.(Compare Terra Cotta Coverings in Art. 68).

Note 176. See the preceding volume of this Handbook (2 nd edition) Fig. 98, page 130.

202. Stone Beam Ceilings.

Stone beams were replaced in time, as for the ceiling of the portico of the Greek temple, thus by the wooden beams on the Roman, and this change of material likewise occurred in the ceilings of similar rooms of less depth, open to the air in front.203. Stone Slab Ceilings.

203. Stone Slab Ceilings.

But instead of the detailed stone beam construction, recourse was preferably had to a covering with coffered slabs, as already developed on the Parthenon and the Erectheium at Athens.

Ceilings of horizontal stone slabs in the simplest form, whose covering stones were dressed smooth above and beneath, are found in the lower gallery of the Amphitheatre at Arles. The slabs are there narrow, 1.48 ft. thick and 10.6 ft. in clear span, forming both the floor of the upper, and the ceiling of the lower gallery.(Fig. 262). In order to keep the height of the building within moderate limits, the construction of vaults is here avoided, though found everywhere in similar structures. The same reason must indeed have produced the same arrangement at the Amphitheatre in Pola.

In order to avoid the thrust of a vault against four free piers at the angles, it was also preferred in the substructure of the spina in the Circus at Vienne, to cover with horizontal stone slabs a story 26.25 ft. high and supporting an obelisk 52.5 ft. high, now called a "needle". The middle space of this ceiling is first enclosed by a series of stone beams, that rest on the enclosing walls and on the massive through keystones of the four arches' a great slab then traverses its middle axis, and upon this rest smaller ceiling beams, thus forming the horizontal covering of the ceiling. The obelisk resting thereon is built hollow internally; thus the ceiling over the open space has no load to support, except its own weight, and it is

[illegible] of the bolts [illegible] stop [illegible] of the [illegible] (Fig. 529).

[illegible] still [illegible] the spacing of the [illegible] they are also [illegible] on the [illegible] the [illegible]

[illegible] on the cell wall [illegible] of the [illegible] reference to the [illegible] as the [illegible] for a [illegible] they [illegible] other [illegible] they consist of [illegible] of the wall of the cell. Fig. 528. [illegible] that [illegible] the [illegible] of the [illegible] [illegible]

[illegible] (Fig. 530) [illegible]

[illegible] the [illegible] a wall, has [illegible] for [illegible]

On the [illegible] of the wall [illegible] doors [illegible] [illegible] with [illegible] of the [illegible] of the [illegible] of interest [illegible]

only loaded by the weight of the hollow obelisk above its bed on the four enclosing walls (Fig. 263).

Coffered slabs still cover the portico of the so-called Temple of Vesta in Tivoli; they are also found on the little Temple of the Vestals at the foot of the Palatine in Rome.

While at Tivoli, all coffered slabs in a better way consist of narrow pieces, which rest on the cell wall at ona end and on the entablature of the colonnade at the other and adjoin radially without reference to the division into coffers, while at the Temple Vesta in Rome, for a passage only 3.15 ft. wide, they join each other concentrically with oblique joints, i.e., they consist of two pieces in width, one of which rests on the entablature and the other on the wall of the cell.(Fig. 264). Finds in the most recent period have shown, that through blocks also occur, which even project internally beyond the enclosing wall, the crowning cornice of the internal wall being wrought thereon in simple form.[177]

Note 177. Compare Hülsen, Ch. Die Ausgrabungen auf dem Forum Romanum. 1898 - 1902. Mitt. der Kaiser; Deutsch. Archaeol. Inst. Röm. Abth. Vol. 17, p.88 of Heft. 1. 'ome. 1902.

In both examples, the original wooden coffered ceiling is recalled by that of stone. The division of the surface into supporting beams and covering panels is furthermore a proper structural method with stone slabs as well, which is recognized as correct and is still employed for heavy and strongly projecting cornice and balcony slabs. The endeavor to produce bearing and enclosing parts in any space-enclosing surface, whether it be a ceiling or a wall, has now become a system for every material, both for practical and for economical reasonr.

On the dressed paneling of the wall, on the doors, the horizontal wooden ceiling, the stone wall strengthened by buttresses, on vaults and metal castings, -- we find everywhere the same principle, which may be stated as similar in form, without our having to assume the direct transfer of forms in construction from the materials used earlier to those employed later.

More freely, though not contrary to the style, were treated the forms of slab ceilings in the buildings of the late period. The plain subdivision into square or rectangular coffers was dropped and gave place to an animated play of lines of inter-

[illegible] and Doric [illegible], like those [illegible]
of the [illegible] at Baalbec and Palmyra (Fig. [illegible]).

The [illegible] in stone [illegible] the [illegible] of [illegible] of the revolving stones [illegible]. [illegible] is not [illegible] to any [illegible] a [illegible] centuries, [illegible] which [illegible] structural [illegible].

The [illegible] of wood [illegible] from the [illegible], [illegible] and [illegible] requirements of [illegible]. The [illegible] were [illegible] by the [illegible] a [illegible] of [illegible] within the [illegible] each other [illegible] with [illegible], [illegible] of [illegible], for [illegible], [illegible] is given in Fig. [illegible] I, II, and III, [illegible] of [illegible] and [illegible] the [illegible], after the [illegible] of [illegible].

[illegible] VI. [illegible], Vol. [illegible], [illegible] and [illegible].

[illegible] and [illegible].

[illegible] the [illegible] and Greeks [illegible] the [illegible], Vol. [illegible].

[illegible] as [illegible], [illegible]:—

1. The [illegible].
2. The [illegible] and [illegible] of [illegible].
3. The [illegible] of the [illegible].

[illegible]

intersecting bands and panels with ornaments, like those shown by the ceilings of Baalbec and Palmyra (Fig. 265).

The coffers (panels) in stone slabs have the purpose of reducing the weight of the covering stones without weakenink their strength; therefore they are not limited to any particular form. A preference in practical respects indeed affects the wooden ceilings of the later centuries, to which the details of stone slab ceilings were transferred, but not their structural principle.

The entire lack of wood in the Hauran from the first compelled the builders to construct stone beam ceilings, both for simple living rooms and for the great apartments of public buildings. The short beams were supported by the enclosing walls and by a system of transverse arches within the rooms. Laid close beside each other and covered with mortar and a layer of sand, these simple stone beams of rectangular section formed the ceilings, the floors and the roofs of the houses.

An illustration of the different systems of covering with stone slabs, for horizontal, inclined, and semicircular forms of ceilings, is given in Fig. 266 I, II and III, Kaiserieh of Chagga and the Pretorium at Mousmieh in the Hauran, after the statements of De Vogue.[178]

Note 178. See De Vogue. Vol. 1, p. 47, 48, and plate 7).

b. Arches and Vaults.

"Etruria gave the arch and Greece supplied the orders." (Choisy. Histoire de l'Architecture. Vol. 1. p. 337. Paris. 1899).

As in all Roman art, we must likewise in vaulted construction distinguish betwwen periods, which are:--

1. The Etruscan period.
2. The semietruscan and semigrecian period of republic.
3. The period of the empire.

The first and also a part of the second shows us arched construction of ashlars set without mortar but perfectly cut and set, the third period builds and vaults with concrete (Choisy terms it an "artificial monolithic construction") and artificial stone, the wall surfaces being covered by costly materials.

204. Roman Vaulted Construction.

204. Roman Vaulted Construction.

Stone beams and stone slabs indeed made possible an entirely monumental ceiling; but they did not suffice for covering larger rooms, especially whenever free supports must be avoided as far as possible. Vaulting was already in use in Asia and Egypt at an early date, and it occurred in Greece in some tomb chambers, gateways and passages, or in structures of utility in the Alexandrine period, it was employed and perfected by the Etruscans in works of utility and ornament (canals and city gates), and it furnished the means for satisfying this requirement also. It was possible with this to construct ceilings of uniform strength and of monumental appearance, and at the same time to place far apart the enclosing walls of the interior to be covered.

While Grecian art scarcely succeeded in creating an enclosed interior of grand effect (merely consider all temple interiors with narrow aisles and the columns timidly placed in tiers above each other to support the ceiling), we here see that in time were perfected porticos and halls covered by domes, tunnell and cross vaults, which uniquely existed in architecture in their dignified spaciousness and were never surpassed in size and boldness of construction, only the Byzantine and the art of the Italian Renaissance equal the Roman in the practice of vaulting and in the creation of mighty and thoroughly impressive interiors, in their structures of S. Sophia, S. Maria del Fiore, and S. Peter. The introduction of mortar and of burned bricks in architecture made possible the erection of such nobly conceived architectural ideas.

The first Etruscan-Roman undertakings in the domain of vaulting were executed with dressed ashlars set withiut mortar, that extended over modest spans. This practice was never entirely abandoned, and it was retained for certain kinds of buildings until the latest period. The art of vaulting quite depended upon the building material at hand in one or another province, on its quality and its more or less costly preparation, and further on the abundance of wood in the locality in which the structure was to be erected. Where wood was abundant, or in other words, scaffold and centering materials could be cheaply obtained, then vaulting on a centering was easiest and most ad-

advisable, that with bricks and mortar or concrete being quickest and cheapest.

Vaulted structures in Nimes, Palmyra, at Pont-du-gard, etc., exhibit in their construction or owe their peculiarity to the fact indeed, that men were compelled to use the least possible quantity of material for centering. At Pont-du-Gard, which carried drinking water to Nimes over its arches and dates from the Augustan period, for this reason is certainly omitted the bonded jointing of the vousscirs in width. Its arches consist of ashlar arches built beside each other and independently. Only one of these arches required a centering and not the entire tunnel vault. When an arch was constructed, the centering was removed and the second one was commenced on the same centering, merely moved sidewise, etc.

This system had been tested on a large scale and found further use for the funnel-shaped tunnel vaults of the Amphitheatres in Arles and Nimes (Figs. 267, 268), on the old Bridge in Avignon, on the stepped tunnel vaults of the so-called Temple of Diana at Nimes (really a Nympheum and a part of the Baths), whose middle aisle is covered by a broad tunnel vault constructed of ashlars, the side aisles having tunnel vaults of ashlars set without mortar (Fig. 269). The right side aisle shows three offsets at the ceiling vault, which are composed of 3 and 4 rowlock arches; the ends of these stepped tunnel vaults are left open to permit the daylight to enter freely, without having to fear the admission of rain water. This peculiar construction was indeed compelled by the arrangement of a staircase in the same room (Fig. 270). The execution is extremely careful; the bed and end surfaces of the ashlars are wrought smooth, and the jointing of the latter is so close, that one can scarcely pass a sheet of writing paper into them. Seen against the light, there appears a hair-like opening at the joint, not obstructed by anything. The separate ashlars are connected by metal cramps. Worthy of mention here is also a portion of a column, wonderfully fine in workmanship, from whose base springs a circle of acanthus leaves, out of which rises the shaft of the column. The execution and the forms indicate the Augustan period.

This vaulting in adjacent rings without bonding appears to

have been especially preferred for works of architecture and engineering in the eastern part of Gaul, and it is characteristic of them.

Of the tunnel vaults constructed of ashlars in Nimes and Narni, one is divided into supporting arched ribs and intermediate covering slabs; the other shows a bonded coursing of the voussoirs with the covering ashlars. In one course, the voussoirs of the ribs extend through the entire thickness of the vault; in that lying above this, they are only set inside the real vault (Fig. 271), and the covering ashlars extend without interruption. The ashlar vaults in Nimes could be erected with a single arch centering, since each arch of the vault is independent of the others, and the covering ashlars could be set in the rebates of the arched ribs without any special centering.

For the vaults in Narni, a centering was necessary for two arched ribs, and that of the first rib might be employed for the 3 rd, 5 th, and 7 th ribs, etc., that of the second for the 4 th, 6 th, 8 th, etc.

Large ashlar vaults for buildings were especially constructed in Syria, while the preference was given to brick and concrete vaults on Italian soil. Almost all known kinds of vaults were built of the materials mentioned.

The oldest tunnel vaults exhibit concentric external and internal vault surfaces, thus having a uniform thickness; those thicker at the crown or springings belong to a later period. A skew tunnel vault is preserved at the city Gate in Perugia.

The complete semicircle remains the rule for the curvature of the vault, rarer is the segmental arch.

Connection of the voussoirs by metal dowells or cramps was not employed by the Etruscans' they were not thought to be required for the Grecian stone buildings in Sicily, and as in the structures of Pericles in Greece, they again forst occur in the ashlar monumental structures in imperial Rome. Mortar bonds in the setting of stonecutter's work are found only in Syrian buildings and in those on African soil.

1. Tunnel Vaults.

205. Tunnel Vaults of Ashlars.

We find the simple tunnel vault constructed in tomb chambers,

over the cells of temples, in triumphal arches, baths, amphitheaetres, and basilicas.

a. Built of ashlars, it is either as alriedy shown, built coursed and bonded lingthwise, or it consists of arches set beside each other. Ĝhiefly employed were voussoirs of equal dimensions, set without mortar and in some cases prevented from slipping by indents or iron cramps.

Small tunnel vaults as a rule have the visible under surfaces left smooth and they are of uniform thickness; exceptions have the vault thicker next the sprining or the crown. The latter is true of the arch; it is also found in tunnel vaults on the frequently mentioned Triumphal Arch at Orange (Fig. 272).

We see the tunnel vault divided into ribs and compartments in the examples mentioned at Narni and Nimes. We find it in Baalbec 74 ft. in span and extending over the cell and the vestibule of the great Temple; the first courses still remain there and present for the vestibule a depth of 5.58 ft. (Fig. 273) at the springing; the vault of the cell was subdivided by heavy arch ribs corresponding to the half columns of the walls. Horizontal supporting ribs in the thickness of the vault, thus forming a subdivision of the tunnel vault into caissons, are not found in these great ashlar vaults; the apparent transfer of a wooden coffered ceiling to the semicylindrical surface of the vault cannot be established here; rather does their form recall the semicylindrical ribbed ceilings of the ancient grotto-temples of India.(Karli Grotto-Temple, 150 B. C.). The small tunnel vaults of the triumphal arches form an exception thereto; they almost entirely have coffers (Fig. 274).

A tunnel vault, executed after the same basal ideas as these and entirely of white limestone ashlars, has been finely preserved for us in all its parts, the ceiling of the so-called Temple Esculapius in the Palace Diocletian at Spalato. The vault covers the rectangular cell of 16.4 × 24.0 ft.; the side thrust is received by walls 5.58 ft. thick, the vault has a uniform thickness of about 1.97 ft. It is composed of arches of 5 voussoirs each, each of which is adorned by two richly ornamented coffers, the joints of the voussoirs being arranged in the middle of the borders of the coffers. The tunnel vault

rises above the Corinthian crowning cornice of the plain, carefully jointed and pointed walls, likewise built of ashlars of white limestone.(See the corresponding illustration in Chapter 18 on Temples; Fig. 685).

206. Tunnel Vaults of Bricks.

b. For tunnel vaults constructed of bricks, men either employed the ordinary bricks or those of special shape. The latter were only used in vaults of small span, where it was necessary or desirable to avoid the use of centering. The same principle of arches set beside each other is then utilized, as for vaults of ashlars.

The model for this kind of vaulting is indeed to be sought in Assyria. The vaults of the sewers of Khorsabad consist of successive arches composed of 7 tile-like bricks of special form with radial joints. The arches are inclined, the vaults thus forming a smooth surface neither internally nor externally. By means of this inclination, the centering was omitted. One arch was set against the next in mortar, not too thin. If the shaped bricks were larger and the span of the vault was small, these could be erected without centering, even with a vertical position of the arches, as shown by a sewer vault from Eleusis (Fig. 275).

The tunnel vault of a cistern of 18. ft. span and built of arches of flat bricks, where the oridnary rectangular bricks were employed, 14.6 ins. long, 10.6 ins. wide and 1.18 ins. thick, was long since uncovered on the eastern slope of the hill of the Acropolis in Athens. In this tunnel vault executed after the so-called Moller's system, the arches are separated by bands of coarse sand mortar 1.57 ins. thick. The large plain tunnel vaults of the later period exhibit the now most common method of vaulting with ordinary wall bricks, which are covered with thick radial layers of mortar; the covering is not always were carefully executed, as shown by a tunnel valut of 52.5 ft. span in the Baths of ~~Constantine~~ Caracalla at Rome. (Fig. 276).

The voussoirs in many cases were not set directly on the plank centering, but on a layer resting thereon, consisting of small and carefully set small bricks, which was plastered with coarse mortar after the removal of the centering of the vault, and it was then finished with a coating of fine stucco (Fig.276).

If complete centerings were to be omitted and only centers for arches with their widely separated lagging boards were to be employed in the construction of the vault, there were first laid on the latter large flat tiles, 23.6 ins. square, next were small square tiles, and on these were first set the voussoirs. But this double layer of tiles was chiefly employed, if the vault was to be constructed of concrete.

207. Of Concrete.

Constructed of mixed concrete and bricks, plain tunnel vaults must be entirely erected on a centering, remaining thereon until a certain degree of hardening of the mortar occurred. Such vaults were built with reference to the material and economically. They consisted of a system of brick transverse arches at certain distances apart, but connected together by larger flat tiles.

The tunnel vaults of 19.7 ft. span of the buildings on the western slope of the Palatine are composed of a series of brick arches, consisting of three rings intersected by tiles, and which stand at a distance apart, that is somewhat greater than the width of the brick arches. The latter are again connected by flat tiles, that extend from one arch to another at each 9 to 11 courses (Fig. 277). This skeleton is in nowise very carefully and accurately constructed; (Choisy[179] in his excellent work makes the construction much better than it really is); but good bricks and still better mortar compensate for the defects, the lack of accuracy.

Note 179. L'Art de Batir chez les Romaines and L'Art de Batir chez les Byzantines. Paris. 1873 and 1882.

The interspaces left by this vault skeleton were filled with a mixture of small pieces of tufa or bricks and mortar, the whole forming a shell of uniform thickness of 1.97 ft. Ribs and filling united and hardened into a rigid mass, whose composition was again concealed from the eye beneath the ornamental plastering, the original component parts were not characterized by the decoration of the vault, or they were not made visibly prominent.

But the surfaces of the vaults were also animated and their weight was reduced by the arrangement of coffers, which in the form of regular polygons, squares, rectangles, lozenges, trian-

triangles, octagons, etc., extended in varied patterns. But the principle of the vault constructed of arches with connected rings was not abandoned here, as shown by the massive tunnel vault of 79 ft. span, of the Basilica of Maxentius in Rome. (Fig. 276).

One cannot say that its end arch with the thickness of two tiles was constructed with particular beauty, the joints radiate from all possible centres, yet not according to the form of the arch, and yet the ancient tunnel vault still stands and shows no crack at the crown after more than 1500 years. How great the strength of good mortar is to be estimated in time is shown by the tearing out of the arch of almost 26.3 ft. span in a division wall, on which rest the two great tunnel vaults, an example showing that the existence of the building cannot be impaired (Fig. 278).

Comparison with other vaulted structures of the later period permits increased surprise at the magnitude of this early undertaking. For example, in the rooms of the side aisles covered by tunnel vaults might easily be placed the cathedral of Limburg, the Church S. Thomas in Berlin, etc.(Fig. 279).

It is also to be noted, that heavy stucco ornaments were fastened on these vaults by means of iron anchors, examples of which appear in the fallen portions of the Basilica of Maxentius, or they were fastened by inserted wooden dowells, remains of which are shown in certain soffits of arches in the Baths of Caracalla.

208. Form of Arch.

For these tunnel vaults the form of arch was either semicircular or segmental' the latter was chiefly employed for small structures, ceilings of rooms of private houses (Pompeii) etc.

In end and soffit arches is almost everywhere found the special form of a round arch, that according to the magnitude of the arch is set from 0.99 to 3.94 ft. behind the face of the pier (Baths of Caracalla, Basilica of Maxentius, Temple Minerva Medica, etc.). The offset thus produced is again filled by masonry carried up vertically to the arch, so that in the decorative treatment of the face of the arch, the pure semicircular form of the arch is no longer retained. The form is too undecided for it to have resulted from esthetic causes; it

must indeed be derived from technical methods. It was desired to give the centering an immovable end support and to dispense with posts beneath those places, as now generally used, and the offsets at the imposts were a suitable expedient for this. The pure form was sacrificed to an advantage in construction.

209. Unusual Constructions.

We find the tunnel vault with inclined crown over the stairways in the amphitheatres [180] and as annular vaults for the aisles of these structures. These are structurally treated on the same basal principles as the straight tunnel vaults. They sometimes make apparent a less careful choice of material, when roughly dressed quarry stones or river boulders are employed for vaulting. Alternately horizontal and inclined at definite intervals is built a tunnel vault of ashlars in the Amphitheatre at Treves (Fig. 280).

2. Cross Vaults.

210. Forms.

The cross vault is a later invention. We find it constructed over square and rectangular rooms, also over long porticos, one set beside another, connected by short tunnel vaults into a unified system, with solid enclosing walls and with those great openings, and which frequently shrink into four limiting piers with open arches on the four sides.

For square rooms, the diagonal arch rises directly from the angle of the pier (Palace Imperial, Arch of Janus in Rome, etc.), or columns set in the angles with a deeply bonded impost slab receive the springing of the vault, or in repititions, columns set before the wall bear the vaults on fully developed entablatures. The architrave, frieze and cornice then do not rest solely on the columns attached to the wall, but they are fixed deeply in the masonry of the wall (Compare Villa Hadrian, Basilica Maxentius, Baths Diocletian, etc.).

The cross vault for rectangular rooms is an interpenetration of two tunnel vaults of unequal lengths, but of equal spans. The crown of the vault coincides in plan with the centre of gravity of the figure. The springing of the diagonal arches are therefore not in the angles of the walls; but each one is just one-half as far therefrom, as the length exceeds the breadth of the room, and all the four tympanums have the same

form and size. This arrangement has the advantage, that the portions of the transverse walls, which are met by the tunnel vaults, appear to be left as buttresses for the cross vault and permit a construction of the longer walls with less thickness.(Compare Baths of Caracalla in Fig. 281).

Reasons of construction and of form (ornamental) indeed led in time to raise the crown of the vault above the highest point of the wall arches and permitted a less sharp accenting, i.e., a rounding of the groins to appear advisable. This led to a definite kind of cross vaults, that frequently appear in the chambers of tombs, one in which the groins near the imposts project more strongly, but they are ever more rounded toward the crown, so as to finally be entirely lost in the concavity of a spherical surface. These were finally built by the Byzantine architects in particular, and they remain in use in modern art in Italy even to the present day.(Compare Raphael's Loggias in Rome, Loggia of Palace Doria in Genoa, etc.). In order to satisfy the requirements mentioned, the diagonal arches of the vault could not be elliptical, but must form a portion of a circular arc, and the vault was the stronger, the higher its crown was made.(Fig. 282).

211. Cross Vaults of Ashlars.

a. Cross vaults of ashlars. -- Cross vaults constructed in this manner are not found in great numbers in Roman buildings in the East and the West, and they are alone mostly for intersecting tunnel-vaulted galleries or aisles. Where space permitted, it was further preferred to avoid this intersection of two tunnel vaults and to allow one tunnel vault to only commence above the other;(for example, compare the lower aisles in the Colosseum at Rome, in the Amphitheatre at Verona, and many others; see the corresponding illustrations in Chapter 21, d; Figs. 742 to 766). The Romans of the East, the people of Asia Minor and of Syria, on the contrary, took up the interesting problem in stonecutting, and thus the few cross vaults built of ashlars remaining to us belong to the oriental schools. Therefore they are especially notable, since their stonecutting survived through the entire middle ages and had been previously retained by the Arab architects.

The most ancient example of this kind must be a Tomb at Perg-

Pergamon of the period of the Attalides, whose construction is shown by Fig. 283 I, and in confirmation of what is stated above, let there be taken the method of execution of an inclined cross vault in the campanile of the Mortarana at Palermo, given in Fig. 283, II.

In the substructures of Baalbec are found cross vaults constructed of ashlars, that exhibit exactly the same stonecutting with bonded groin voussoirs, that we born later are accustomed to use in the same case. In Gerasa (Djerasch) and Bergamon, instead of the bonded voussoirs, we find in the construction of the groins a bonding extension of the coursed ashlars of one vault beyond the other.(Fig. 284).

If the intersecting vaults with the same impost height do not have the same diameter, then compartments are produced. They were erected as independently supporting vaults in Pergamon (according to Curtius in the second century B. C), the voussoirs being so adjusted to the surface of the intersected vault, that the voussoirs of the latter could easily be fitted. (Fig. 284).

In the substructures of the Odeum of Herodes Atticus at Athens, an inclined and a horizontal tunnel vault intersect to form a complete cross vault, while that in Pergamon is only one-half. The latter dates from the period of the Attalides, the 2 nd century B. C., the former was constructed in 160 A. D., both without portar between the ashlars.(Fig. 285). In the great ashlar structures in Nimes and Arles (1 st and 2 nd centuries A. D.), the builders avoided the cross vault. In the Colosseum completed under Titus, we find the same evasion in the two lower stories, while cross vaults are emoloyed in the three next upper galleries, but not of ashlars, only being of mixed brickwork and concrete. The ground plan of Basilica Julia (dedicated by Caesar while incomplete in 46 B. C. and enlarged by Augustus) exhibits cross-shaped piers and hence we may infer its covering by cross vaults. The great basin Piscina Mirabilis near Bacoli, which formed the termination of the Julian Aqueduct, likewise has cross-shaped piers, but it is covered by parallel transverse tunnel vaults and not by cross vaults, so that here again is the cross vault avoided. What is true and still remains at the Julian Aqueduct may

also be assumed for Basilica Julia and the Saepta Julia completed by Agrippa.

On a great scale and to a larger extent first occurs the cross vault for the halls of the baths, the imperial palaces, the Basilica Maxentius, and the street arcades of the succeeding imperial period of the western Romans, and Choisy must be right, when he says of the cross vault:--[181] "The example is taken from perhaps the most ancient cross vault in existence, that of a tomb in Pergamon, which dates from the era of the Attalides."

Note 181. In Histoire de l'Architecture, vol. 1. p. 519. Paris. 1899. Also see Curtius. Mahl-Tepa. Abhandlungen der Akademie der Wissenschaften. Berlin. 1872.

212. Of Bricks and Concrete Masonry.

b. Cross vaults of bricks and concrete masonry were constructed for spans up to 50.5 ft. (Basilica Maxentius). Side and groin arches were built of brickwork crossed by flat tiles, just as described for tunnel vaults. According to the span of the vault, these rings are made single, double (Arch of Janus) or triple (Palace Imperial); the flat tiles in all cases have their angles cut off to the surface of the vault; others intersect these surfaces radially. The cells between this brickwork skeleton are filled with concrete, as shown, of equal thickness. Diagonal ribs and side arches also disappear here likewise under the plaster covering of the masonry.(Figs. 286, 287). Besides the plain surfaces of the vaults, coffers were also used here as for tunnel vaults.

For a cross vault over a rectangular room in the Baths of Caracalla, we see the springing (Fig. 288, the space from b to a) entirely built of bricks and in the same plane with it from a to the crown, the centering is covered by large tiles, behind which are small tiles with the concrete on the latter. In another, the tile covering is carried down to the springing, without a springing of brickwork; but the concrete must then extend to the former.

3. Domes.

213. Development.

The dome or the spherical vault in its simplest form, without intersection, subdivision or skylight, judging from repres-

representations on reliefs, was already built at an early date in Assyria and probably still earlier in Chaldea, and it only found its way to Rome relatively late. The first domes were constructed by horizontally corbelling (compare the treasuries) or by annular courses slightly inclined to a horizontal; thus the oldest extended in rather a conical form than in an accurately hemispherical one. First built over a circular room, there were later added the experiments over decagonal, octagonal and square plans.

While the dome could be directly placed on circular rooms, special preparations were necessary for polygonal interiors in order to make possible the transition from the angles of the polygon to the hemisphere. The Roman architects in the Hauran at first made this transition by means of stone slabs (Fig. 289), a system of construction that could only be employed for small rooms. The polygonal room in the West made the transition easier, the more so the greater the number of sides in the polygon. If the diameter of the dome equals that of the circle inscribed within the polygon, then the masonry of the dome rested on the enclosing walls for a distance at the centres of the sides of the polygon (compare D in system I, Fig. 289), and only a portion of it projected freely beyond the angle into the interior.(B, D', a', C).

214. Pendentives.

The most natural form for the supports of those parts, or for the transition from the vertical to the vault surfaces was the spherical triangle, in this must be sought the origin of the pendentive. The beginnings of it awkwardly appear on the Roman buildings of brickwork, on the so-called Temple Minerva Medica, the tombs on Via Praenestina and some polygonal rooms of the Baths of Caracalla. The supporting triangles therein do not have purely spherical surfaces, for the transition is effected by gradually corbelling out horizontal courses. Therefore a groin results in the middle of the pendentive, which disappears near the beginning of the dome. (Fig. 289, system I, x y in plan and section). The form is still indefinite. If the diameter of the dome were equal to that of the circumscribed circle of the polygon, then the intersection of an 8 or 10-angled prism with a hemisphere would be formed. A section

through the centre and angle of the polygon would give a great circle of the sphere. The spandrel between the crowns and the springings of two side arches would then be part of the dome. (Fig. 289, system II). Over a room 17.7 ft. square, we find the dome built of brickwork in a Tomb on Via Nomentana near Rome, in the so-called Sedia del Diavolo.(Fig. 290).

It was again the Romans of the East, who passed beyond the limits of the awkward attempt and created for us pendentive domes of ashlars and of brickwork constructed over square rooms. They were found in the ruins of Gerasa (Djerasch) and in Asia Minor in the valleys of the Meander and the Hermus, and these are indeed not occasional examples; but entire buildings are vaulted in this manner. These ashlar vaults are set without mortar and exhibit the jointing shown in Fig. 291, the brick vaults having an equally excellent jointing by the insertion of dressed stones (B, B) instead of the usual voussoirs (C, C), that form a plainer ending. In Gerasa, the calotte and pendentives belong to the same spherical surface (Fig. 291, system III); in the valley of the Meander were in part constructed the calotte and pendentives of different spherical surfaces. (Fig. 291, system IV).

These are not works of grand importance, but in them we recognize the precursors of S. Sophia and S. Peter. The so-called Byzantine art is based on or is identical with the Roman of the East.

Viollet-le-Duc [182] regards S. Sophia as the first dome on pendentives, but believes that the question must be left undecided, whether it be a specifically Byzantine structure, or whether it was borrowed from oriental buildings no longer existing or unknown.

Note 182. Dictionnaire Raisonnee de l'Architecture. Vol.4. p. 347. Art. Coupole. Paris. 1875.

Isabelle [183] accepts the spandrel of Temple Minerva Medica as a perfected pendentive. He accuses Agincourt of an error, since he mentions as pendentives the Tor de' Schiavi (Tomb on Via Praenestina) and rooms of the Baths of Caracalla; for neither he nor Blouet have perceived these, and Tor de' Schiavi is perfectly circular. But there now lies somewhat above Tor de' Schiavi an octagonal structure (Fig. 292), that has the

required peculiarities, and there are likewise rooms in the Baths of Caracalla, that show the same (Fig. 293); thus Agincourt is indeed correct. Judging from his work, Blouet did not see the intersecting compartments in the great domed interior of the Baths of Caracalla, and yet they exist.(Fig. 294).

Note 183. Les Edifices Circulairse et les Domes classees par Ordre Chronologique, etc. p 69 - 71. Paris. 1843-1845.

The small tomb with square chamber on Via Nomentana avails as authentic evidence of the use of the pendentive by the Romans. The authentic examples are now mostly from the discoveries in Syria. Compare thereon Choisy's work, L'Art de Batir chez les Byzantines (Paris. 1883), a clear and reliable treatise, like his great work, L'Art de Batir chez les Romains, (Paris. 1873), whose contents I have frequently compared with the facts on the spot, and which I have always found trustworthy in its statements. His conclusions are just as ingenious, thoughtful, simple and cogent, as his illustrations and drawings, the latter only being almost too beautiful.

215. Domes over Circular Rooms.

a. Domes over circular rooms. -- A dome constructed of ashlars without mortar has been preserved to us in the small Temple at Baalbec, at least in the lower courses.

With a diameter of 31.8 ft., the thickness of the wall is one-tenth of this, aod the thickness is one-twelfth the height of the enclosing wall. The latter is weakened by 5 semicircular niches and by a doorway 13.1 ft. wide. The thrust of the vault is not concentrated at certain points of the enclosing wall, but it is uniformly distributed over the entire outer wall by the regular annular coursing of the voussoirs, which are dressed smooth inside.

The Roman West was characterized during the last years of the republic by domes constructed of bricks and concrete. The enclosing walls on which they rest are built of the same materials. (Concrete faced with brickwork).

A rather heavy structure of this kind is one of the previously mentioned tombs on Via Praenestina near Rome.(So-called Tor de' Schiavi, parts of Villa Gordian, a Heroon according to Nibby), a two-story circular structure of 46.0 ft. internal diameter and with walls 8.4 ft. thick.(1 to 5.08).

The dome and outer wall are constructed in the same manner.

The latter is ornamented by semicircular and rectangular niches; instead of the usual opening at the crown, 4 small round openings are left in the spherical surface, which dimly light the interior.

b. A notable mode of construction is presented by a Tomb in Tivoli (so-called Temple della Tosse), a circular building with a diameter of 41.9 ft. and 6.56 ft.thickness of the upper part of the wall.(1 to 6.2).

The dome is divided into three zones' the first has a height equal to one-third the length of the vault line, and is constructed by corbelling out small tufa stones with mortar, this zone being faced with flat tiles radiating from the centre. From this commences and extends through the second zone a system of brick ribs, that are connected together by horizontal rings of flat tiles, which abut against the third zone or the skylight ring. That has its lower half built of flat tiles 17.7 ins. wide and set inclined, above these being 13 horizontal courses of bricks (Fig. 295). The intervals between the ribs are filled with concrete masonry. This is one of the few domes besides the Pantheon, which have remained uninjured till the present day.

c. The so-called Temple Jupiter in Spalato, internally circular and externally octagonal (Tomb of Diocletian, now the Archbishop's Cathedral) exhibits for a clear span of 44.3 ft. enclosing walls 9.5 ft. thick.(1 to 4.7).

The latter are penetrated by 7 niches 6.56 ft. deep and a doorway; the construction of the dome entirely consists of small brick arches, that begin on the 8 great semicircular arches above the springing, a structural caprice previously referred to on occasion of a similar arched construction in Treves. Choisy [184] gives the arrangement of these pendentive arches differently from Adam.(Fig. 296).

Note 184. L'Art de Batir chez les Byzantines. Paris. 1883.

The building (Figs. 297, 298) [185] was restored by Hauser [186], and the interior has been free from scaffolds only for some years. A certain darkness prevails in the interior, to which the eye must become accustomed before it can recognize what is remarkable. The vault appears dark on account of the insufficient skylight. Fortunately the restoration was devoted rather

to the preservation of the building than to restore its condition in the time of Diocletian; only somewhat too much emphasis is placed on the ornamental sculptures. In a skilful manner, the dome has not been covered with plaster, so that its construction may still be recognized. What Adam prefers for it is not entirely clear. The statements of Choisy do not wholly correspond to the reality. Correct is the division of the perimeter of the dome into 12 great semicircular arches, between which extend fan-like smaller arches of bricks. Adam incorrectly gives bricks set on edge in the compartments, while Choisy represents horizontal bricks, which agrees with my observations on the spot. The semicircular arches above the springing on the lower edge of the dome are laid up with 33 courses of bricks laid flat and separated by thick beds of mortar. The lowest fan-arch between these arches shows 17 courses of the bricks laid flat, the succeeding arches having 10 such courses. The fan courses are there so arranged, that those of the second row at the crown of the great arch occur on the middle line of the lowest spandrel, an arrangement correctly drawn by Adam. The fan courses disappear at the crown and give place to complete circular rings, where the idea is not to be rejected, that the dome originally exhibited an opening at the apex, as constructed at the Pantheon in Rome, and that the dome was externally visible as there, and was not covered by a hip roof, as at present.[187]

Note 185. From a photograph by Joseph Wiha in Vienna.

Note 186. Compare Hauser, A. Spalato und die römischen Monumente Dalmatiens etc. Vienna. 1884. p.

Note 187. Compare Eitelberger, R. Gesammelte kunsthistorische Studien. Vol. 4. Die mittelälterliche Kunstdenkmale Dalmatiens. p. 255. Vienna. 1884. The dome of the Cathedral at Spalato. -- Further, Lanza, F. Dell' antico palazzo di Diocleziano in Spalato. Plate 6. Trieste. 1855. Spaccato del Tempio, where the arrangement of the fan arches is correctly given. -- Finally, Cassas. Voyage Pittoresque et Historique de l'Istria et Dalmatie. Paris. 1802. -- Plates 45, 48, where the arrangement of the fan arches is also properly given.

The execution of the domical vault in fan arches, that is to be termed a caprice, but it perhaps had the advantage, that

with it so far as the fans extended, the centering could be omitted. For the construction of the uppermost third of the vault to the crown, a light centering might suffice.

b. As an example of a great structure of the first rank, of a dome above a circular room with a clear span of 142. ft.,may be mentioned the Pantheon in Rome, whose original purpose and the construction of its dome have given occasion for many treatises, which have left open questions concerning the technical part, and which even today cannot be completely answered.

It is determined and we know, that the substructure consists of concrete masonry faced with brickwork, which is carefully executed, and the masonry is intersected by doubled and tripled discharging arches extended above each other. As still visible at the portico, part of the masonry was externally covered by slabs of white marble; other portions might have been plastered. Old engravings (Roma Antiqua ---plate 38, by Lafrerio) represent an arrangement of small pilasters on the exterior, that indeed were never executed. Judging from the mode of junction, the portico must have been erected only after the completion of the rotunda, for reasons that every one versed in construction would find self-ewident at the first glance. The surfaces of the walls are now covered by stucco and a veneering of marble, that terminates at the impost cornice. Above this rises the coffered vault, open at the top and covered by light grayish-yellow rough plastering, which is subdivided into 5 zones with 28 coffers in each. At the skylight is still a richly ornamented bronze ring, that permits the conjecture that the dome was ornamented with metal. It is now externally covered on the upper surface with sheet lead. Its springing is concealed externally by the higher outer walls, by a plain attic and by a number of annular steps, that are carried up for half the height of the dome.

For the construction, we must accordingly trust in great part to the statements of others. Under Benedict XIV (1747), restorations were undertaken on the building; then apparently became visible the system of vaulting published by Piranesi (1756) and Canina (1840), that consisted of 8 ribs connected by arches, and which rest against the skylight, with concrete masonry filling the spaces between them. This construction does not appear im-

impossible, if it be assumed that the dome consists of two shells, one abowe the other. It cannot be arranged in the internally visible coffered dome, for ribs and arches would be arbitrarily intersected by the coffers, or it must have been limited to the uppermost plain zone, and the ascending ribs are too far apart for this. If a second shell be assumed, the construction described must have occurred therein. But that is entirely concealed behind the extension of the external attic and beneath the stepped structure above the principal cornice. The attic and the stepped structure must have been entirely destroyed in some places for the construction to become visible in all its parts. But the condition of the external wall and cornice does not permit an assumption of such destruction. Therefore one might easily be tempted to believe that Piranesi furnished his readers with an invention of his own. (Compare the latest data on this domical construction in Chapter 18; The Temple; Art. 437, p. 550 et seq). In consideration of the uncertain statements, the following assumptions or constructions are permissible.

In all cases, the enclosing wall is divided in height into three stories, and it is a hollw structure with internal cell-like rooms, in its middle story being arranged an arched structure corresponding to the niches in the plan, and which in part extends through the entire thickness of the wall and conducts to definite points of the external wall the thrusts caused by the weight of the dome. These points coincide with the side walls of these niches. Thus the external wall with the niches extending through all three stories may be regarded as consisting of two circular walls at a certain distance apart, and which are joined together by cross walls at the points S, S 1, S 2, S 3 (Fig. 299). These radial walls were then the concealed buttresses of the domical construction; they are placed inside and the spaces between them are joined to the main interior as niches. They disappear in the peculiar arrangement of the plan, as at the Basilica of Maxentius and other large structures, while they also appear externally at Temple Minerva Medica and the so-called Temple of Venus in Baiae.

The statements relating to the construction of the drum are to be accepted as reliable. The ancient marble facing of the

second story had become defective, was removed by the papal architect P. Posi and replaced by the existing covering of plastering. The wall must have been laid bare during this process, and an error can scarcely have occurred. Between the through triple arches A A extend smaller double arches, that receive the load of the masonry of the dome above them and transmit this to the former, which rest upon the sides of the niches. (Fig. 300).

According to the example of the Tossia Tomb near Tivoli, the dome of the Pantheon can only consist of a single shell and the ribs between the coffers extend through above each other to the skylight ring and are stiffened by broad horizontal rings. In the upper plain zone may also be inserted some rings of tiles. The panels enclosed by this skeleton of brickwork were filled with concrete masonry, that has the same thickness as the ribs in the upper zone, but recessed in the 5 lower rows of panels by stepped centerings, in order to obtain the coffers in the simplest manner. To remove these wooden centerings for the coffers more easily, when the centres of the arches were left or taken away, the horizontal sides of the coffers were not made normal to the curve of the vault; they radiate from the centre of the ground plan. But if an optical effect were further designed, this can only be enjoyed from a single point by a single observer, from the centre of the ground plan.

It is not impossible that the course and the extension of the ribs and rings toward the skylight occurred in the manner shown by Piranesi, but with the difference that one-half the ascending ribs extended to the vertex, and that the plain portion was covered in the manner given in plan on the right side of Fig. 300. It is then less important that the dome consists of a single shell.

If we desire to adopt the statements of Piranesi as fully as possible, there remains nothing else than to assume a double shell and to leave to the Romans [188] the priority of the invention of the double dome, which must appear to be scarcely possible.

Note 188. See also in reference to this, Viollet-le-Duc, E. Dictionnaire Raisonnee de l'Architecture. Vol. 4. p. 347. Art. Coupole. Paris. 1875.

The objection to a heavy substructure or to one of moderate buttressed construction will still be somewhat lessened, if we consider that we really only have to do with an enclosing wall of concrete masonry 5.9 ft. thick, from which preject 8 coupled or altogether 16 buttresses 14.8 ft. wide, which receive the entire structure of the dome. The ashlar buttresses of the Cathedral of Cologne do not project to a much smaller width from the outer wall; these are external and those of the Pantheon are internal.

For the statical judgement of the vault, buttresses and stresses acting on the concentric annular wall, the sections in Fig. 301 afford indeed the best conclusions. The diameter and the height of the interior are equal; they are as 1 to 1, as at the Cathedral of Cologne; likewise the actual dimensions of these two buildings (taking their cross sections) nearly coincide, as shown by the diagram. The projection of the buttress from the enclosing wall amounts to 1/11 the span, the width of the buttress including the outer wall is 1/7.5 of the same, and the thickness of the outer wall is 1/24.

e. In the class of great structures is likewise to be placed the rotunda of the Baths of Caracalla with its clear diameter of 115 ft. The drum and vault here likewise consist of concrete masonry with a brick facing; the latter is executed on the vault in the interior, so far as this remains.

Fifty-five ft. above the floor rose a clearstory of 8 great windows spanned by segmental arches, and the crown of the vault was indeed thereby enclosed. The segmental arches of the windows are portions of complete semicircular arches, that indeed lie in the curved structure but are still in its vertical external walls. The imposts of these arches coincide with the springing of the dome. The connection of these vertical arches with the overhanging surface of the spherical vault must lead to the design of compartment vaults. Fig. 294 D exhibits the present condition of a pier with the springings of the arches and the compartment vault; the latter are constructed with extreme care and beauty and are models in the direction of the jointing. From this fact, the original form of the dome may be restored without difficulty, and it also affords evidence, that the reconstruction of the Baths attempted by

Blouet, although very commendable in other respects, is not correct in this part, and that the domical vault with intersecting compartments (lunettes) is a Roman practice. The dome is about 19.7 ft. too high in Blouet. Nothing can now be determined concerning the construction above the lunettes. (Fig. 302).

f. The domes at Baiae, really parts of former Baths, are likewise made prominent by imposing spans, for they exhibit clear spans of from 92. to 97. ft. But strictly considered, they do not belong in the class of vaults, since the forms and coursing of the stones have nothing to do with radial jointing. We indeed owe their preservation and strength to the adhesive strength of mortar of earth from Puteoli.(Pozzuoli).

The so-called Temple of Venus, a rotunda of 94. ft. clear span with 4 semicircular niches, 4 passages in the lower part of the drum and 8 window openings in the upper portion, is built of concrete masonry with facings of brickwork and of opus reticulatum of tufa.

The enclosing wall is strengthened by buttresses (Fig. 303); the thickness of the former averages 1/10 the clear span. The brick facing in the interior of the room is in horizontal courses,and it extends in semicircular form above the segmentally arched windows (Fig. 303). In the spherical pendentives between these arcades is inserted straight coursed masonry of small tufa stones arranged in tolerably regular courses, which indeed continue to the crown of the vault. The similar semicircular extensions of the horizontal courses of the brick facing reappear in Temple Minerva Medica; a special structural value cannot be attributed to them. (Fig. 303).

Better preserved is the dome of the so-called Temple Diana, since one-half is preserved to the crown. The vault line is here already peculiar, for it shows the shape of a depressed pointed arch.

The drum of the rotunda is 97. ft. diameter inside, and it is of concrete masonry faced with bricks and tufa stones in alternating courses. This kind of masonry is carried above the upper clearstory, above the tops of the 8 great windows. There commences a zone of 28 courses of bricks, which are

bonded by flat tiles B and B, (see Fig. 304 and the represetation of a photograph in Fig. 305), above this being a second zone consisting of regularly wrought tufa stones 12 ins. long and 3.5 ins. high, that are bonded by the tile course B 2; the succeeding masonry to the top is of regular and smaller tufa stones. But the stones of all the courses up to the crown are not set radially to the centre of the line of the vault, but are in horizontal courses. The thickness of the vault diminishes toward the crown, in the vicinity of which it still meausures 3.94 ft. The entire external surface is covered to a thickness of 4 3/4 ins. with mortar mixed with finely pounded bricks, this being still in excellent preserwation and forming the protecting shell of the vault.(Fig. 304). The lightness of the stone, the pointed line of the vault, the goodness and adhesive strength of the mortar permit the horizontal coursing for the great span.

The various principal differences in the technical execution of these mighty spherical vaults may be sufficiently recognized in the examples mentioned under a to f.

216. Domes over Polygonal Rooms.

b. Domical vaults over polygonal rooms. -- Above polygonal interiors, the domes cannot be directly set on the drums as for circular interiors; it requires a special arrangement, the pendentive, as shown in Art. 214. These are produced by corbelling or vaulting.

The more nearly the polygon approaches the circle, the less danger occurred in its construction. Thus for the decagonal ground plan, the attempt could also be made for the greater spans, for example at the so-called Temple Minerva Medica in Rome up to 82 ft. The construction of the pendentive is not accurately determined, since the plastering covers the surfaces in question (Fig. 306); but judging from other structures, it is composed of corbellings of bricks.

The construction of the dome continues to be interesting, since the insecure system of vaulting given by Piranesi for the Pantheon at Rome -- discharging arches in the surface of the dome -- is exposed, even if this be in small dimensions. The external walls consist of concrete masonry with brick facing and the vault of brick ribs and concrete.

From the reentrant angles rise broad ribs constructed of brickwork bonded by 5 through courses of tiles, that extend to a ring at the vertex. Above the crowns of the doubled window arches, that extend through the entire wall, there rises in the middle of each side of the decagon a second system of 2 ribs each, which extend only one-half the height of the dome and are connected together by small semicircular arches. All these ribs are joined together by a series of horizontal rings of tiles, and they altogether compose the framework of the dome. The spaces between the ribs and the rings are filled flush with concrete (Fig. 307). The thrust of the dome is led to the ten angles by this arrangement, which are accordingly strengthened by buttresses (see plan and external view in Figs. 339, 341), while the solid walls have a thickness of only 1/16 of the clear diameter.

The system of mediaeval vaulted construction, the transmission of the thrust of the vault to definite points of the mediaeval vaulted structure here appears or exists in germ, just as in the cross and tunnel vaults. It is only necessary to permit the ribs to project from the surfaces of the vault and to make them of corresponding sections in order to obtain in this Roman construction of vaults, what Gothic architecture has brought to us.

Over octagonal rooms, greater care must be devoted to the construction of the pendentive, especially if their dimensions are important. Examples of such are preserved to us in an octagon at Tor de' Schiavi (about 42.6 ft. clear span) and in a side apartment of the Baths of caracalla.(About 65.6 ft. clear span).

They are executed in brickwork, gradually corbelled out with disappearance of the groins, as shown by Figs. 289, 290. The dome above these pendentives for the interior first mentioned was constructed like the second zone of the Toffia dome near Tivoli; in the second, it consisted of concrete masonry on a shell. The construction of the dome of S. Lorenzo in Milan, that might be placed here, is not subject to technical determination in its present condition. Furthermore, its Roman origin is doubted.

The form of this dome, which is strictly a "cloister vault" over an octagonal room, coincides with those of the Baptistery

and of the Cathedral at Florence -- a form that is but seldom found in the larger Roman domes over polygonal ground plans. For this reason, the assumptions of Hübsch appear to me more justifiable than those of Burckhardt. Fey Roman cloister vaults are known, while Early Christian art employed them extensively.

Fig. 308 gives a comparative series of spans and a view of the proportions of the polygonal and circular interiors of medium size and of prominent buildings of ancient and modern times. In symmetry of proportions with interesting and skilful construction, Temple Minerva Medica always excels all other examples mentioned.

Domes over square rooms only have to be indicated in the Roman West for small tombs, in the East on Syrian buildings, that on the Tetrapylon of Latakieh [189] attaining a span of 31.7 ft. At a Kalybe in Chagga and at the said Tetrapylon, structures of the 3 rd century A. D., the pendentives are simply constructed by corbelling out the ashlars.(Compare what was said of the domes of Gerasa and in the valley of the Meander in Art. 214.

Note 189. Compare De Vogue.

c. Cloister vaults are given by Choisy (vol. 1, p. 519) as being in the ruined galleries of the Theatres in Gerasa and Nicea. Very well preserved and executed in brickwork and concrete masonry over an octagonal room with a side of 11.5 ft. are some in the ground story of the Palace of Augustus beneath Villa Mills on the Palatine at Rome. These cloister vaults have openings at the crowns for the admission of light.

4. Niche Vaults.

217. Niche Vaults.

The niche or choir vault is to be found on the great exedras of the temple porticos and the baths, in basilicas, heroas, as the terminations of temple cells, and for the covering of semicircular niches in walls. Accordingly, we find the vault executed in all dimensions, from the small niche 3.28 ft. wide to the great exedra 81. ft. wide.(Baths of caracalla and Palace of the Emperors at Rome).

218. Of Ashlars.

a. Built of ashlars, there remains to us those in the exedra of the fore-court of the great Temple in Baalbec (diameter

of 34.8 ft.), on the niches of the City Gates and those of the Tomb of Diocletian at Spalato (14.4 ft. diameter), and on the wall niches of Gerasa. The jointing of the stones varies with the span. At the place last mentioned, the wedge-shaped voussoirs are set around a semicircular block; in Baalbec and Spalato, the voussoirs are in annular courses and the niche domes are cut from a single block.(Figs. 310 to 312).

At the locality last mentioned, since the close of the work of restoration, the keystones of the niches project down into the domical surface; their lower portion is roughly pointed, while the surfaces of the two courses beneath them are dressed smooth. The joints in the surfaces of the vault are marked by square sinkings.(Fig. 311 b). On the Golden Gateway there, the half domes of the niches are cut from a single block each. (Fig. 311 c).

219. Of Brick or Concrete Masonry.

b. For a construction in brick or concrete masonry, usually only the face of the vault is built of several rings of bricks bonded by tiles, the semicircular part being of concrete masonry placed on a concrete shell of tiles set in mortar, frequently bonded by tiles placed normal to the line of the vault.

At the great exedra in the Baths of Caracalla, there occurs on the front a doubled brick arch 3.95 ft. high; then occur in the curved surface from the springing upwards 54 courses of bricks, above which to the top was employed concrete on a shell of tiles. The small niche vaults of the Temple Minerva Medica have a diameter of 20.8 ft. and were constructed with especial care, since they must in part support the wall of the next story and are composed of a quarter sphere and a tunnel vault, while on the face, they have a facing of courses of bricks and have doubled brick arches in height, on which rests at right angles a doubled beam extending through the curved surface. The latter is bonded with horizontal rings of tiles and the framework is filled with concrete.(Fig. 313).

As a structural advance in the so-called decadent period, I might designate the construction of the niche vaults in the circular vestibule of Palace Diocletian at Spalato, where from the impost upwards some courses are executed as horizontal rings, above these only rising the radial voussoirs.(Fig. 311a).

By this arrangement the construction of a separate face arch becomes unnecessary, and the danger is avoided, that the upper portion of the niche may fall or press outwards at the front, while the mortar has not fully set.

220. Compartment Vaults.

c. By the arrangement of the lunettes or by the intersection of vertical windows at the height of the springing, compartment vaults were produced at the great rotunda of the Baths of Caracalla; these were drawn in and extended to the crown of the vault, producing a fan-like subdivision or decoration of the great sphere, as shown at the canopus exedra of Villa Hadrian near Tivoli. (Diameter 56.0 ft.; Figs. 314, 315).

The vault is divided into 7 sectors in the plan, 4 of which remain with the spherical surface, while 3 are shaped as ascending tunnel vaults with diminishing diameters. Since plaster covers the vault, its construction in detail cannot be determined.(Fig. 315).

221. Coffers and Horizontal Vaults.

d. Divided into coffers like the tunnel vaults and domes, we find the niche vaults in Hadrian's Temple of Roma and Venus in Rome. Graceful lozenges animate the surfaces of the vault in the most beautiful manner.(Fig. 316).

As a form of vault lying between the ceiling of the caldarium of the Baths of Caracalla and the canopus exedra near Tivoli, must be the ceiling vault in the octagonal structure near the Piazza d'Oro of the same Villa Hadrian, which is not quite correctly shown in plan on plate 6 of the otherwise remarkable publication of Winnefeld.[191] The octagonal room was covered by a dome; for which was provided a circular skylight opening at the crown, as plainly shown by the springing blocks io the vault. The dome itself was ornamented by 8 compartments extending upwards, whose groins disappear at top in the surface of the vault, thus showing no sharp separation. The strongly swelled compartments are separated from each other by rib-like bands. Both parts start from a common springer cut from travertine, beneath which originally stood a column, which is yet indicated by a corresponding pentagonal base on the floor.(Fig. 317). We have here the beginning for many mediaeval ceilings and wall treatments of polygonal rooms, to which the Renaiss-

Renaissance returned and must return. The shafts or columns in the angles from which the subdivision of the vault developed are like these, gifts from the antique and not a later invention! If we mould the ribs and allow them to distinctly project up to the crown and to abut against the light ring, then is the mediaeval interior complete.

Note 191. Compare Jahrbuch der Kais. Deutsche Archaeol. Inst.; Erganz. Heft 3; Die Villa des Hadrians bei Tivoli. By H. Winnefeld. Berlin. 1895.

Horizontal arches are mentioned' they become loaded vaults at the octagonal structure in the ground story of the "House of Augustus" beneath Villa Mills on the Palatine in Rome. Over its horizontally covered niches, that have a clear width of 11.5 ft. and a depth of 7.9 ft., with a uniform thickness of 1.97 ft., these vaults have stood for nearly 2000 years without showing cracks.(Fig. 318). With solid construction, selected material for the masonry and good mortar, the art of vaulting may dare much!

As a horizontal vault of ashlars, the ceiling of the Mamertine Prison in Rome may be regarded (Fig. 319). Earlier than the Nympheum ascribed to the king Servius Tullius, it has recently been accepted as a domed tomb in the form of the Tholos of Mycenae.[192]

Note 192. Compare Pinza. G. Bericht über das Tullianum. Bullet. d. Commis. Commun. di Roma. 30 th year. Rome. 1902.

Canina and those, who have studied it, have not recognized the primitiwe form, which may easily be distinguished in the remains.(Fig. 319). The present lower cell has nothing to do [illegible]
with the upper one; it is a circular cell, mutilated upwards, and belongs to a tomb, that was covered in the form of a pointed dome by corbelled courses. Four courses of it remain, which therefore accord with the Etruscan period. The upper cell forms an irregular quadrilateral, about 19.7 ft. long, 9.85 ft. wide and 6.56 ft. high; both were only connected by an opening in the ceiling. This ceiling was constructed without much care for the parallel positions of the stones of the vault, since 5 courses were placed parallel to the external wall a e and the others intersect these parallel to the line

A B. For completing it, recourse was necessary to the miserable expedient sketched, that was further not entirely unknown to Roman construction elsewhere, as shown by the semicircular arches in Arles with the skew jambs. (I and II and the filling course A in Fig. 319).

Sallust describes the place in connection with the beheading of the associates of Cataline, where Jugurtha and Vercingetorix likewise ended their lives; "In the prison is a room called Tullianum about 12 ft. below the surface of the ground. it is enclosed by walls and over it is a ceiling formed by a stone vault; but its appearance is hateful and terrifying on account of the neglect, darkness and stench."

222. Pottery Vaults.

For the examples previously mentioned, the materials named for the vaults are limestone, bricks, lime mortar and pozzulana. It was likewise stated, that for the great vaults were preferred materials of very light weight, volcanic tufa of extreme porosity.

In Pompeii (Stabian Baths and potter's kiln before the Gate Hercules) and in Rome (Tor de' Schiavi -- octagonal structure -- Torre Pignatura on Via Labicana -- Tomb S. Helena -- circus Maxentius, Temple Minerva Medica, Arch Janus Quadrifrons), pots are frequently built into the vaults.[193] This custom may, as stated, extend back to the end of the republic. Furthermore, it was not at all the actual static reasons, that induced the Roman of that period to employ this material; he merely sought to utilize for building purposes broken vases, that were made of excellent clay. These are scattered over the entire surface of the vault, frequently are grouped or isolated, and the occur in the abutments just as much as at the crown of the vault.

Note 193. Compare Nissen, p. 64, -- further Overbeck, J. Pompeii in seinen Gebäuden etc. 2 nd edit. p. 389. Leipzig. 1884. Lastly, Choisy, A. L'Art de Batir chez les Romains. p. 96. Paris. 1873.

The fallen dome near Tor de' Schiavi (Villa of Gordian) shows in the fragments lying on the ground the arrangement and form of pots illustrated in Fig. 320. The Byzantine architects first utilized this material for their vaulted construction by

a systematic arrangement and proper statical distribution. In Ravenna, pots inserted into each other (C in Fig. 321) form in circular courses a series of inseparable rings, a method of construction, that reappears in the domes of the structures on Mt. Athos in a somewhat different form, where between the usual voussoirs are set rings of hollow tiles covering each other(A in Fig. 321). The use of pots for vaults has continued until this time in Syria, and Fig. 321 B exhibits the form of such a pot.

The best known and most famous example of vaulting on a great scale with pots, left by the Byzantines, continues to be the dome of the well known S. Vitale in Ravenna, which in spite of its "Byzantine" details is almost wholly Roman in arrangement and construction. Begun in the year 526, the building had progressed so far after 8 years, that the execution of the mosaics could be commenced.[194] In plan it has the greatest similarity to the western Roman buildings of the 3 rd century, for example, the Temple Minerva Medica at Rome. The diameter of the dome, that rises over the polygonal substructure, is 52.5 ft. Concerning the construction of the dome, for which Isabelle[195] gives a comprehensive representation of the actual conditions in the year 1827, this learned architect says:-- "We have not been able to measure the form and size of the pots composing the vault on the monument itself, but in the Museum at Ravenna." He makes the statement, that the pots are inserted in each other and rise spirally, so that the vault may be made light by them. He further says:-- "Two pots appear to form the thickness of the vault, as we believe ourselves compelled to recognize at an opening in the crown." Thus the statements are not sufficiently definite as to be accepted without further information. And if Overbeck[196], in describing the vaulting of a potter's kiln in Pompeii with a similar method of construction, speaks of the "ingenious" construction occurring on a great scale in the dome of S. Vitale in Ravenna and at the Church S. Sophia in Constantinople, and which alone made possible the erection of such wide domes, seeing in the regularly coiled spiral both durability and lightness of construction, it must be said on the other hand, that the practical Choisy[197] terms the construction a "singular procedure", in which good mortar plays

the chief part, a view adopted by Isabelle and the author also. It may further be opposed, that the dome of the Church S. Sophia in constantinople is not composed of pots (clay vessels), but of porous bricks from the island of Rhodes, that a span of 52.5 ft. cannot be termed great, and that the clay vessels with the mortar cannot be called anything less than a "light" material, since a vessel with the mortar filling was weighed by me at 1.78 lbs.

Note 194. Compare Mothes. O. Die Baukunst des Mittelalters in Italien. p. 44. Jena. 1844. -- Further, Isabelle, who places the consecration of the building in the year 547 A. D. -- thus in the same period in which the Sassanides appeared with their vaulted structures.

Note 195. Same work, plate 48 and p. 99.

Note 196. Same, p. 7 -- likewise 1866, II, p. 7.

Note 197. In Art de Batir chez les Byzantines, p. 71. Paris. 1883.

Isabelle[198] mentions various kinds of pots; larger vases of 1.75 and 2.07 ft. in height (Fig. 322), which he places in the substructure of the dome, and smaller ones of 0.565 ft, which he only assigns to the domical vault. Repairs were made on the building quite recently, which afforded opportunity for somewhat more closely examining the pots of the dome in place. One of these original pieces is in the possession of Professor von Duhn (Dean of the Archaeological Institute at the University of Heidelberg), and was drawn by be as shown in Fig. 323. The small pots are cylindrical and have the modest dimensions of 5.5 ins. length and 2 3/8 ins. diameter; they mostly have a point 2 3/8 ins. long and entirely hollow, even in the slender point. The external surface is slightly incised in order to make the mortar adhere better; in the specimen seen by me, the hollow interior was entirely filled with fine lime mortar, that projected at the mouth and at the point of the small vessell. From the hard mortar adhering to the exterior and the impression left on it by the adjacent vessel, the distance between the pots can be determined. (Fig. 323). The assumption of Isabelle, that the vault consisted of two successive rows of pots as in Fig. 322, with an average thickness of 12 ins., must be correct. Isabelle with good reason does not accept

pots for the crown. Their peculiar form as drawn differs considerably from that otherwise known, and it shows that these terra cottas were made for the particular purpose and were not pots for domestic use.

Note 198. See Isabelle.

According to Dartein, the same method of construction must have been employed at the Baptistery in Ravenna (5 th century, according to Dartein), likewise at the Chapel S. Satiro in the Church S. Ambrose at Milan, as also in a side chapel of the Baptistery of Constantine in Rome. But these statements could not be verified by me.

Concerning S. Vitale, Corrado Ricci, entrusted with the work of restoration in this church and now engaged as Director of the Uffizi in Florence, wrote me in the most obliging manner:-- "Posso invece dirla che i vasi che formano la Cupola di S. Vitale non sono spirale, ma in tante file concentriche, doppie, formanti un infieme appunto circa 30 Centemetri." Isabelle is correct in reference to the thickness of the vault and the domical shell constructed of a double row of concentrically placed pots; but he was entirely mistaken in the spiral rise of the rows of pots.

In the little museum at the Cathedral of Grado (Fig. 324), I found in the autumn of 1903 a similar pot for vaulting, such as employed in Ravenna, but which was stated to me as having been found at the locality.

Concerning the vault of the potter's kiln in Pompeii mentioned by Overbeck, Mau communicates to me the following in the most friendly manner;[199] -- "The span of the vault is 3.78 ft, and its rise is scarcely more than 1.31 ft. The pots were not burned for this purpose, but they are of the form well known otherwise; it likewise occurs in the collection of clay vessels, that is now taken from hence to the Museum at Mentz. The vault commences at the only course to be recognized in any way, with a broken pot at the lowest part. The entire structure is very much ruined, none of the pots now being in place. The pots are filled with mortar, but some mortar is put in as a bed for the succeeding pot, as indicated by hatching on the drawing. (Fig. 325[200]). The vault consists of seven adjacent rows of pots stuck into each other."

Note 199. On Oct. 4. 1903.

200. See likewise the description referred to in Mau, A. Leben und Kunst in Pompeii. p. 379. Leipzig. 1900.

A collection of forms of pots is given in Fig. 326, from a drawing of Bergau,[201] but it must be considered questionable, whether they were fitted into each other as shown. Two forms of pots are given from the Saalburg Museum in Homburg (Fig. 323), and although these are inserted in each other in the Museum, it also appears doubtful whether they are antique or were ever employed in vaults. They are indeed allied in form with those stated to be known to be from Rome.

201. In Annali dell' Istituto etc. plate L. 1867.

It may finally be stated that Promis also found vases in pendentive masonry, which were filled with mortar and pebbles from the Dora, and which date from the Augustan period. In the walls (not in the vaults) of buildings on the Tiburtine Gate, of the Nympheum of Egeria in Rome, and also in the masonry of the so-called Sedia del' Diavolo outside the Gate Pia in Rome, I found vases. They were set as headers during the construction of walls by the Byzantines, as Choisy states.[202]

Note 202. In l'Art de Batir chez les Byzantines. p. 13. Paris. 1883.

223. Final Considerations and Sassanian Vaults.

To examine here the Byzantine system of vaulting in its entirety, after the similar works in the western Roman method already came into contact therewith, and the competition of both, so strikingly characterized by Burckhardt in the words:-- "Architecture was at a crisis at that moment, vaulted monstruction with its relatively new organism was carried out in decided contrast with the impotent and stumpy forms of earlier architecture of Grecian temples, and wonderful magnificence must have been the prevailing character of the designs of Constantine; domes, niches, circular porticos, costly incrustations, gilding, mosaic, -- the essential elements of this rich and unquiet entirety."[203] This must indeed be of high value for a comparative knowledge of architecture, in connection with and for comparison with the succeeding Arab, Mediaeval, and Renaissance Methods, but it cannot be further extended here, and it would be better if made the subject of a special work.

Note 203. Compare Burckhardt. J. Die Zeit Constantins der Grossen. 2 nd edit. p. 420. Leipzig. 1880.

What is then presented to us as new by the Byzantines are the vaults on pendentives, the dome over square rooms with or without the calotte, the combination of the pendentive vault with tunnel vaults and niches, in order to transfer the thrust to the external walls or the piers, then an aggregation of both kinds and the visible anchoring of the vault. A later phase of the art of vaulting places the dome on a closed or lighted drum, and a last form crowns the apex of the dome by the addition of a lantern.(Fig. 333).

Under niche vaults (see Art. 219), a system of construction of the era of Diocletian was mentioned, which must be termed an advance in the method of vaulting. We enter upon this with buildings belonging to a later period, the period of the rule of the Sassanides, and shall not forget what has been said of it, that one feels the same breeze blow from the Persian Gulf to Tuscany, more or less strongly, frequently entirely calm in comparison with the succeeding storms. Ancient memories are whirled around by it, the old is swept along by the raging elements, yet the new is also produced. The great cities of the ancestors are animated to do the same.

In the time of Chosroes (573 - 579 A. D.), there arose in Ctesiphon the mightiest monument of the Sassanides; the ancient art of the creation of large interiors with monumental construction, fertilized by the Byzantine undertakings in the domain of vaulting, is here employed again. A palace 298 ft. long and 115 ft. high arose, whose centre is formed by a vaulted hall 84.5 ft. wide.[204] A massive tunnel vault of oval cross section spans the hall and rests upon vertical walls, that are built of bricks and pass into the curve of the vault. For 5/7 of the height of the hall, they are built of bricks laid horizontally, and a part of the curve of the vault is executed by corbelling. The vaulting with joints radiating from the centre is limited to the upper 2/7 of the height, constructed of several rows of well burned white bricks of large dimensions (about 1.58 ft. square), laid with rare skill.[205] Yet the broad sides do not form the beds of the voussoirs, as shown by Fig. 311 e. Thus the placing of the bricks occurs, already

found on works of the period of the Achemenides and reappears on Palace Diocletian in Spalato (Fig. 311 a), though indeed at a very much smaller scale. The courses are likewise not perpendicular to the springing line, they are rather somewhat inclined in order to construct the vault without centering, and the art of vaulting here follows the earlier methods of Assyrian architecture,[206] or even the Egyptian of the 19 th dynasty (1447 - 1273 B. C.; especially of Rameses II, 1392). The vaulted galleries of the Egyptian Ramesseum exhibit the same method of construction as the hall of Sarbistan and that of Tak-Khosra (Fig. 327), for which Dieulafoix assumes the 3 rd and 4 th centuries of our era, while they were previously assigned to the 6 th. Nearly 2000 years lie between the erection of the royal hall in Ctesiphon and that of the Ramesseum in Thebes, thus between the period of the Sassanides and the time, when Rameses led his Egyptians to Asia Minor and the banks of the Tigris.

Note 204. Compare Dieulafoix, M. L'Art Antique de la Perse. Part 5. Monuments Parthos et Sassanides. p. 63. Paris. 1884.

Note 205. Compare the same work.

Note 206. Compare the same. Part 4. p. 14 - 17.

The spans of the tunnel vaults in Ctesiphon are 85.0 ft. and even exceed those of only 74.5 ft. on the side aisles of Basilica Maxentius in Rome, and for a comparison with later works in this domain, that are nearer to us, reference is made to the diagram (Fig. 328), in which is drawn the cross section of the Cathedral of Worms within that of the hall at Ctesiphon.

In forms of arches and lines of vaults, antiquity has given the horizontal and the jointed arches, semicircular, segmental, pure and depressed pointed, elliptical or oval arches; Arab art added to those the horseshoe[207] and foiled, as well as interlacing arches, and in the second millenium A. D. appear ogee and curtain arches as poor beggars. What will the most recent art be able to add to these?

Note 207. According to Borrmann in Geschichte der Baukunst (p. 314. Leipzig. 1904), the horseshoe arch was not an invention of the Arabs; it already existed in the period preceding Mahomet!

Horizontal vaults, tunnel, cross and niche vaults, domes,

cloister vaults, pendentives, tunnel vaults and domes with lunettes and intersecting compartments, the subdivision of the surface of the vault into supporting ribs and filling panels, the arrangement of the buttresses, the direct connection of the arch with the column, the annular mouldings of the latter, the twisted column, the corner leaves on the angles of the plinth, etc.--- antiquity gave us everything and likewise it made known to us all possible technical methods; it also gave us a scale of construction and a magnitude and dignity of appearance in regard to the internal effect, to which later races have not yet attained.

What did the middle ages add to these or perfect, that did not previously exist at a greater scale? The sole innovation in form and construction is and remains in the domain of the art of vaulting, the making the ribs visible, the supporting ribs, partly regarded as merely ornamental, and the mighty arrangement of useless buttresses and piers, with a reduction of the free span to a value far less than that common in antiquity. Furthermore, the tiresome experiments in the transition from domes to a square or polygonal substructure, already perfectly solved by the 6 th century!

224. Combined Kinds of Vaults.

Combined arrangements of cross, tunnel and niche vaults have already been made known by the great public buildings (basilicas, baths and palaces); tunnel vaults with inclined crowns and tunnel vaults in annular forms have been already treated in the galleries and stairways of theatres and amphitheatres as "unusual constructions" (see Art. 209). They belong to the domain of those architectonic forms, whose origin was Grecian, but which were transformed by the Roman builders for their own purposes. In the Amphitheatre at Arles, the annular vault is omitted in the lower galleries and the ancient Grecian ceiling of stone beams retains its rights.

225. Stepped Tunnel Vaults.

Substructures in Forest of Retz at Vivieres (Aisne) and in the Theatre at Bosra exhibit a further development; the stepped ascending tunnel vaults over stairways with and without provision for the admission of daylight and in connection with cross and tunnel vaults, and great tunnel vaults intersected by smaller

smaller ones with the same height of springing for both.(Figs. 329, 330). Over the lower flight of the stairway at Retz, arch adjoins arch; over the upper portion are built short tunnel vaults extending over three steps, and which leave open segmental holes for the entrance of the daylight through the stepped ends. This method of construction is more secure than that of a uniformly inclined tunnel vault. The front arch is built the same for each successive portion, and the same centering may be employed in the construction. But this system of construction did not become general, it remained unknown on Gaulish soil. The ashlars are set without mortar in the arches and tunnel vaults, as in the earleer period.[208]

Note 208. Compare Choisy. p. 126.

At the Bath of Diana in Nimes, greater care is taken for the introduction of light in the stepped tunnel vaults, for in place of the small segmental holes, there occur entire semicircular openings.(Fig. 270). The separate tunnel vaults then consist of 3 to 5 arch rings, as at Pont du Gard, are wrought in the most careful manner and are set without mortar and with a jointing equal to any to be found in the master works of the era of Pericles in Athens, and this is also true for the other great Roman buildings in Nimes and Arles. If If the semicircular openings were closed by latticed windows (iron or bronze lattices and glass), then was the interior secured against injuries by weather, with the addition of the full and beautiful sunlight. Arranged in steps with high front light instead of a skylight! Fig. 269 represents the arrangement of the ashlars for the structure in Nimes with aisles of unequal width covered by tunnel vaults springing at different heights.

226. Inclined Tunnel Vaults.

An inclined tunnel vault in which the end surfaces of the voussoirs are perpendicular and the bed joints are parallel to the springing line is preserved in the City Gate at Perugia. (Arch of Augustus; see Fig. 36).

227. Mixed Architrave and Arch Construction.

The peculiar combination of Grecian trabeated and Roman arched construction occurs most strikingly in both amphitheatres in Nimes and Arles, by which is meant, not the arrangement of

the facades, but the construction. Reference was previously made to the annular vaults of the latter, especially emphasizing the fact, that the vaulted ceiling is generally omitted in the lowest gallery (Fig. 245) and that the vault first appeared in the upper gallery, and only conditionally there. The architrave retains its rights in the construction of the ceiling in connecting the external and internal piers. With a length of 15.5 ft. (Arles) or of 17.0 ft.(Nimes), a width of 2.56 or 2.17 ft., a height of 1.84 ft. or more, it forms the springing point for the construction. These are flush with the sides of the pier, leaving a space between them of (9.85 - 2 × 2.55 =) 4.75 ft. This is filled by a stone arch, that has nothing to support and therefore has a large hollow space above it. On the contrary, the horizontal architraves have to receive the weight of the funnel-shaped tunnel vaults, which do not consist of voussoirs bonded in courses, but of 4 rows of flat stones or arches set beside each other, as on the Pont du Gard. In Arles, the arch turned between the architraves rests directly on the continuous horizontal cornice, i.e., it springs from that, while in Nimes it extends below the lower edge of the architrave and springs from a separate cap, that projects from the face of the masonry.(Fig. 268[209].

Note 209. Also compare Questel, Ch. Monuments Historiques. Amphitheatre d'Arles. --A beautiful and careful representation (5 plates), that has unfortunately remained without text. -- A drawing by E. Gladbach (Vorlagblätter zur Bauconstructionslehre. Zurich. 1888) relating to the Amphitheatre in Nimes (III, 2) is indeed instructive and well rendered, but is not correct in all parts, especially in what relates to the construction of the vault.

When the annular and cross vaults were employed for similar buildings on Italian soil, and they were permitted to appear for themselves, the elliptical gallery in Gaul was divided into funnel-shaped tunnel vaults corresponding in number to the openings and resting on architraves, this gallery thus being divided into visible small parts, each with its own visible covering, so that viewed externally the arched appearance must be entirely different from that of the amphitheatres at Rome, Verona, and elsewhere. There resulted deep jambs and

ceiling panels behind the arched openings together with a stronger effect of the arcades. The loose connection of a portico extending around an inner building as a nucleus does not appear at all, but a strongly joined radial union of the series of piers with the mass of the building. Where is the better architectural idea? Which is the most appropriate method of construction? If the architraves were omitted, certainly for me in Nimes and Arles!

The Sassanides again -- though indeed about 500 years earlier -- took up this question and gave a correct solution by their buildings, especially in the gallery of the Tag Eivan. There are avoided the architraves and the arches turned between them, and which give place to arches that spring lower and in pairs support the semicircular tunnel vaults extending at right angles to the enclosing wall (Fig. 331). The gallery has a width of about 28.9 ft., and its length is divided into bays of 5.25 and 5.9 ft., alternately formed by semicircular supporting arches and by tunnel vaults resting on them. The mixed system of forms of ceiling with arches and vaults, still found in the galleries of the Amphitheatres of Nimes and Arles, is here solved in the form of a complete vaulting. The East with its architectural works is later more opened to the aspiring West, to which fact it is indeed to be ascribed, that the germ of the Byzantine system of vaulting was carried further West and was there tested thoroughly. The studies and publications of Choisy, De Vogue, Dieulafoix, and Perrot on Byzantine (Eastern Roman), Syrian and ancient Persian vaulted structures show to us today their progress and their influence on the monumental vaulted buildings of later centuries in a light somewhat different from the case before.

The accurately dated 3-aisled Church S. Philibert de Tournus (Saone et Loire), commenced in 981 and consecrated, then destroyed by fire in 1006, rebuilt and consecrated again in 1007 - 1019 (Fig. 332 [210]), in nowise differs in the arrangement of the vaults for the middle aisle from the gallery of the Tag Eivan. A full thousand years lie between the construction of the vaulted ceilings of the Roman buildings in Provence and the church architecture in the department of Saone-Loire, and five hundred between those of Tag Eivan and of the

Christian structures mentioned, which include within themselves the chief conditions for the arrangement of the vaults of French Gothic cathedrals. The far East is and continues to be the locality, from which proceeds the suggestions and the further development of the vaulted construction, even if local patriotism would gladly have it otherwise.

Note 210. Also compare the perspective of the interior of this Church in Dieulafoix. Part IV.

228. Comparison of different Domed Interiors.

The only mediaeval (Gothic) central structure in Germany, the Church Liebfrauen at Treves, very surprising for its justly charming picturesque effect, does not produce the feeling of imposing spaciousness in comparison with the interiors of antique central buildings. The arrangement of the numerous isolated supports, the narrow and stilted arch spans, which connect them, destroy the effect of the interior, which is sacrificed to the picturesque charm. The complex structure can be placed without difficulty as a model in plan and elevation within the interior of the Pantheon (Fig. 333 IV, V); the entire array of pillars and vaults is lost beneath the simple and massive vaulting of the Roman domed ceiling.

What we again strive for today; a massive covering of interiors without columns, and which are designed for receiving great masses of people in animated movement, antiquity already undertook for us. German depth of thought reasoned out in Treves and the unfolding of the imposing might of the Deity in Rome are contrasted in both works! Fig. 333, I, II and III are drawn at the same scale and illustrate the epoch-making central buildings for church purposes, as they have appeared from Hadrian under Justinian up to the Popes of the cinquecento period. The divinely favored masters of the Italian Renaissance, who have repaid the school of their ancestors with the dome of S. Peter.

229. Domes on Columns.

But the era of Constantine has another difficulty to show in the sepulchral Church S. Costanza; this omitted the enclosed substructure of the dome and set in its place supporting columns, thus opening the central space toward an adjacent annular and lower side aisle; in other words, the dome was placed

upon columns (Fig. 344), with 4 larger and 8 smaller intervals, columns in pairs are set in accordance with the thickness of the drum of the dome, and which first support an antique entablature, -- architrave, frieze and cornice -- above this being conical tunnel arches with horizontal imposts and crowns rising towards the side aisle, on which rests the wall of the drum and the dome. Any connection of the arches by cross vaults next the side aisles has also become unnecessary here, the annular vault being constructed instead as on the Colosseum in Rome and in the other places mentioned. The drum is erected as a cylinder admitting light, and the dome is vaulted in the manner of the Tossia Tomb near Tivoli: an opening at the crown is probable, but uncertain.

230. Peculiarities of Arched Construction.

Attention must be called to the slight peculiarities in the construction of arches, an example of which is given in Fig. 335. These relate to the jointing between the imposts and pilasters on the Theatre in Arles, where the continuous joints along the shaft of the pilaster were to be avoided. Then the imposts of the arches at the Amphitheatre in Verona, where polygonal ashlars served instead of the voussoirs of regular form. The use of indented voussoirs and those of irregular shape is shown by the junction of the horizontal and round arch on the Gate Aurea at Spalato. Ashlars corbelled out to receive the timbers of the centering and for inspection of the exterior of the structure appear on the Pont du Gard. All of these arrangements are based on technical requirements. But others proceed from affectation and absurdity, if we examine the practical value of certain structural parts on the Tomb of Theodoric (526 A. D.) still extending back into the antique period. A single block of Istrian limestone, measuring 35.8 ft. diameter and 8.2 ft. high, is there hollowed out for the covering dome over the building, while its entrances of about 4.92 ft. width are covered by horizontal arch lintels of small dressed ashlars in part doubly indented. Likewise, the singular jointing of the voussoirs of the cross vault in the substructure and the door jambs (Fig. 336), where one vainly asks, why this labor without purpose or sense? Also in the early Romanesque niche vaults, that likewise are near the

antique, the master workman has been forgotten (Fig. 337,from Cathedral at Murano), and a toilsome caprice occupies the place of a sound and simple construction.

Finally, attention should also be paid to the disregard of a precautionary measure in masonry extending upwards in Fig. 338, the repetition of discharging arches above arched openings beneath them.

231. Buttresses.

The existence of concealed or visible buttresses has already been mentioned in the Introduction and for different vaults. They are built as plain projections of the wall -- of visibly projecting ashlars in the Hauran (Chagga, 2 nd or 3 rd century), of concrete with a facing of brickwork in Italy.(Temple Minerva Medica in Figs. 330, 341; Basilica Maxentius; Baiae in Fig. 342). The spaces between them appear internally in whole or in part, the piers in the latter case animating the external surface of the enclosing walls as vertical members, as in mediaeval buildings. They still in part remain as oblique wall masses above the perforated division walls between the tunnel vaults of the side aisles of Basilica Maxentius; the piers are 10 ft. thick and of trapezoidal form, and they are perforated by round-arched openings, in order to render possible the connection of one area with another in the low side aisles, an arrangement that we find repeated in mediaeval structures.(Fig. 343).

5. Conclusion.

232. Decoration of Vaults.

The decoration of vaults was executed for plain and coffered vaults of concrete and brickwork by the aid of stucco and painting.(Pompeii, Palaces Imperial in Rome, Tombs on Via Latina, etc.[211]). The surfaces of ashlar vaults frequently remained plain in great structures; for smaller tunnel vaults, the motive of the coffered stone ceiling is transferred to the vault. (Compare Fig. 274, Arch of Titus in Rome, Arches in Palmyra and Amman).

Note 210. A very beautiful and comprehensive work with many illustrations of this kind is that of Ronczowski. K. Gewölbeschmuck in Römischen Altertum. Studies and drawings. Berlin. 1903.

Pliny (Book 76, 42) further mentions decoration by pumice stone (stalactites ?), which is especially employed in "museums"(grottos of the muses, study rooms). "Jagged rocks hang down to give the rooms artificially the appearance of a grotto." He likewise states in the same Book, that the covering removed from the floor was transferred to the vaults and was composed of glass. This "new invention" was unknown to Agrippa. He employed in the decoration of the warm rooms of his Baths painting burned on potter's clay, while he had everything else "ornamented" by a white wash; which is usually now considered as a very recent modern invention.

For the stage of the Theatre of Scaurus (Pliny, Book 36, 24) is also mentioned the ornamentation of the wall surfaces with glass. By this must be understood a mosaic decoration with glass paste or enamel. Mosaic ornamentation is still preserved in small niche vaults in Pompeii. Decoration by paintings burned on clay tiles and glass mosaics must have become common, especially in the later period.[212]

Note 212. Rich. A. Illustrirtes Wörterbuch der Römischen Altertümer etc. Translated from the English by C. Müller. Paris & Leipzig. 1862. p. 408. "Musivum" = a mosaic composed of small bits of colored glass or of a combination of enamels, in opposition to "lithostratum", which was made of colored stones.

233. External Ending.

Vault and roof were identical in great structures; a separate protecting roof was not erected over them. The externam form of domes was similar to the internal; for cross vaults, gable roofs were externally imitated and the surfaces of the masonry were covered by tiles or plates of metal. Domes were coated with a fine concrete with which were mixed bits of tiles of hazelnut size, or they were covered with metal plates in rich designs. For the vaults at Tor de' Schiavi and of the so-called Temple Diana in Baiae, the concrete covering is applied in a thickness of 4.71 to 5.9 ins., and it is still preserved. (Fig. 304).

234. Vaults of Iron and Clay Tiles.

Besides these vaults of stone and of concrete, Vitruvius (Book 5, 10) also mentions another kind, that was constructed of iron and clay tiles. Straight or curved iron rods with as

many iron hooks as possible were suspended from the trusses at such distances apart, that tiles found support between each pair, "the entire covering vault thus being supported by iron." The joints were to be covered above with mortar containing hair, on the underside being applied before plastering, a layer of mortar with pounded clay potsherds. The construction of two such vaults above each other is particularly recommended for baths; "for then the moisture caused by the steam would not injure the wood of the roof trusses, but it would disappear between the two vaulted ceilings."

235. Wooden Vaults.

Vaulted surfaces were likewise constructed of wood and stucco, when strips of cypress wood were fixed to the ceiling beams in curved form two ft. apart with wooden clamps and iron nails, and these were covered by flattened reeds, coated with coarse sand mortar on the underside and then plastered with fine mortar and marble dust.(Compare Vitruvius, Book 7, 3).

236. Vitruvius and Vaults.

Besides this last statement, we learn nothing further from Vitruvius concerning arches and vaults, except that above wooden beams loaded by masonry should be formed discharging arches, that the external walls should be made thicker for vaults, and that for arcades of piers, the end piers should be made wider, that they may afford resistance against the "outward pushing of the impost stones." Yet great vaulted structures must have been erected under his eyes, he must even have been acquainted with Etruscan works in this domain. Did he consider it entirely self-evident, that he need waste no words thereon, or was this unimportant to him? Yet scarcely, since he speaks minutely of matters far less important and even unsettled (not for us, but for that era). to consider them as an innovation, that he had viewed without understanding, is forbidden by the well known earlier constructions.

237. Conclusion.

Many of the vaults resist time; earthquakes, imperfect maintenance and exuberant vegetation or intentional destruction by human hands contributed more to the destruction of the greater part, than the quality of the workmanship or the staticil methods employed.

Arches that had become dangerous were improved by masonry or by turning narrower arches, by wedging, and by filling the interspaces with concrete.

Chapter 6. Roofs.

238. Form and Covering of Roofs.

The inclination of the roof surfaces and the construction of the roof resulting therefrom first depends upon the kind of covering material. The imperfections and lack of durability of this demands either a removal of the water as rapidly as possible, or the good quality permits it to remain longer or the collection of the rain water upon it, i.e., thus by this fact will a steep or a flat roof be required.

The roofs of the houses of the Colchians, built in compact form, were covered with earth and leaves; the roofs of the sanctuaries in the citadel of ancient Rome and the huts of Romulus were covered with straw (compare Vitruvius, Book 2, g, 5); the primitive ash chests of Albano show a pointed straw roof and indeed afford a representation of the oldest type of the Italian house. It results from this, that for the South also was the pointed or steep roof the oldest, and it remained in use as long as its perishable covering material was employed.

The covering of oaken shingles, whose use Vitruvius (Book 2, 1) ascribes to the Gauls, Spaniards, Lusitanians and Aquitanians, admits of a lesser angle of inclination of the roof surfaces, and the covering of tiles with tight joints rendered possible the flat roof.

The conservative South still shows us today the steep straw roof on the cabins of the Roman shepherds, on the peasants' houses of the Alpine slopes is the strongly inclined roof of shingles or of stone slabs, while on city houses is the flat clay tile roof, constructed after the antique method. Gable, hip, and conical roofs were known; the latter prevailing in the country, the former in the city. In the gable roof of the temple reappears the form of the oldest Italian city house.[213]

Note 213. For the gable roof of the private dwelling, compare the relief found in Capri, now in Museum Nazionale at Naples; Icaro ed Erigone che festeggiano Bacco Indiano -- further, Nissen, Chapter 24.

239. Roof Construction.

Various antique reliefs, on which also are represented houses, ash chests with imitations of dwellings, the Phrygian

rock-cut tombs, Egyptian reliefs and beam construction, as well as the roof trusses of Early Christian churches, and also such of the middle ages and of the modern period in the country of Italy, as well as the descriptions of the ancient writers and building contracts still preserved (Lex puteolana), all supply us with conclusions or starting points for the construction of the perfected antique roof.

We find everywhere the roof with purlins and through tie-beams, which for greater spans are directly supported one or more times between the end bearings or are suspended from the trusses. ceiling beams, purlins, struts, ties, plates and rafters are combined to form trusses in the manner usual today, and the dimensions of the timbers exhibit no great excess over modern customs.

We everywhere meet with well considered modes of construction with reference to the peculiarities of the materials and the structural and ornamental forms resulting therefrom. On all known examples, the roof rises above and protects the external walls, and the drip cornice is either formed by overhanging rafters or by projecting ceiling beams and rafters.(Figs. 344, 345).

240. Rafter Cornices.

The walls might have had therewith an upper termination by a plainly or richly treated stone cornice. The rafter cornice does not exclude the latter, as is shown by the cornices of Tuscan palaces and houses (Fig. 346, Pisa and Siena), which are indeed traditional and inspired by the ancient spirit. The well known relief (Icaro ed Erigone) of the Museum of Naples exhibits the naked projecting ends of rafters; Vitruvius requires them to be covered in the wooden cornice of the Etruscan temple; the Lex puteolana likewise prescribes such.("Antepagmenta abiegnea, lata (dodrantem), crassa (semunciam), cumatiumque imponito ferroque plano figito"(.

The old reconstruction of the Puteolan projecting roof may well be neglected, which is added to Mommsen's Corpus Inscriptionum Latinarum, but which does not correspond at all to the text. For a rational wooden construction would not so appear, and a constructor would find the conception of Choisy [214] more acceptable.

Note 214. In L'Art de Batir chez les Romains. p. 145. Paris. 1873.

Wiegand [215] has fully devoted himself to the interpretation of the architectural inscription of Puteoli and reaches approximately the same conclusion as Choisy.

Note 215. Compare Wiegand. Th. Die Puteolanische Bauinschrift sachlich erlautert. (Separate reprint from 20 th Supplement volume of Jahrbuch für Philologie. Leipzig. 1894.

Wiegand first fixes the date (105 B.C.), the copying, the conditions, and then the building programme. For the reconstruction, he employs the Etruscan temple roof and a series of antique and modern gateways with projecting roofs after the form of that at Puteoli. One of these from an Apulian vase in Naples, [216] likewise a garden gate behind S. Stefano Rotondo in Rome, [216] the last of which in particular agrees pretty well with Choisy's drawing.(See Fig. 345).

Note 216. See Choisy, the same, p. 722, 726.

On plate II of his work, Wiegand gives geometrical and perspective sketches of the projecting roof with its ornamentation and the entire construction of the interior, which illustrations may lay claim to entire accuracy. The difference between the attempts at restoration by Choisy and Wiegand consists in the treatment of the ridge. Wiegand lets the upper ends of the rafters extend into the wall and carries this vertically above the ridge, while Choisy omits the coping of the wall and is satisfied with a crossed connection of the ends of the rafters (see Fig. 345) and a regular gable roof, unbroken in any way. Had Wiegand extended the coping (margo) somewhat higher, his reconstruction would also then be faultless from a technical point of view.

It was not absolutely necessary to cover the ends of the rafters, as the well known Tuscan wooden cornices still show. The end wood could be protected by the projection of the lowest row of tiles or by special tiles with water drips, like those shown in Greece and southern Italy.(Fig. 347). But the protection would be more perfect with the coverings attached; then the wooden strips (antepagmenta) could be covered with terra cotta slabs, as indicated by the remains of so many small terra cotta friezes with reliefs, painted and with nail holes, or

the protecting band with the drip tile was made in one piece, remains of which are found in Metapontum.(Figs. 347, 348).

Gutters are nowhere shown on such rafter cornices, and they were indeed not in use, for they were hollowed out of long pieces of wood and fastened to the rafters, as on the Tyrolese and Swiss houses of our time, to which adheres much of ancient tradition. The adoption of terra cotta gutters in short pieces on such a movable support as an overhanging rafter cornice would have little sense, and it would be practically objectionable.

Likewise the covering of the purlin and beam ends is required by the building contract of Puteoli. ("Insuper id et antas mutulos robustos II crassos (bessem), altos pedem I proicito ... Insuper simas pictas ferro figito."). These can only have been small wooden boards or terra cotta plates, or both. We also find them again on the well known Tyrolese wooden houses.

241. Stone Cornices.

Wooden cornices were in time supplanted by stone cornices, at least in the cities. The covering cornice of the wall was allowed to project further, to it was assigned the problem of protection, the beams and rafters were cut back, and their e ends were loaded by the internal portion of the projecting stone cornice.

If one wishes to derive the form of the stone cornice (originally of the Doric style) from the ancient wooden cornice, investigation leads to the already established results, that the ceiling beams originally formed a part of the wooden cornice, and these must be assumed to be not behind the triglyphs, but above them. The construction of the ancient wooden cornice, as stated, may best be referred to Etruscan works. As in the wooden buildings of those provinces in which wooden architecture has been in use from the most ancient period, this was composed of the projecting beams and the rafters set on them, their ends extending beyond the former. If the framework of the cornice thus formed be covered with boards, i.e., the covering be fixed to the ends of the beams and rafters, then directly resluts the typical form of the Doric stone cornice, yet evidently without its ornamentation. The projections of the wooden beams and rafters may be included or omit-

omitted, as shown by the examples illustrated in Fig. 349 from Akragas (internal angle represented in its present condition), Segeste and Rhamnus.

On all Doric temples, the stone beams of the portico lie at the same height above the triglyphs, which speaks in favor of this derivation of the stone cornice from the wooden cornice composed of beams and rafters. This possibility was previously referred to in the Division "Architecture of the Greeks"[217] it gives very decided evidence against the Vitruvian idea of the triglyph. But one may likewise leave this to the first explanation of the stone cornice as the bringing forward of the crowning cornice of the enclosing walls.

Note 217. See Part II, Vol. 1, 2 nd edition, p. 13, of this Handbook.

The slight projection of the stone cornice (especially if porous limestone of small resistance must be employed for it) no longer afforded the same protection against rain for the walls as the wooden cornice. By a projection of the lower row of tiles beyond the edge of the cornice, it was sought to throw the water further from the building, though with small results. (Fig. 350). In weather free from wind, the water fell along the sides from the outer edge of the tiles directly down to the ground, or in a storm it was blown against the cornice, wall, or columns.

242. Gutters for Water.

Reasons that might be regarded as inapplicable in the primitive discharge of water from buildings of hard stone, like marple, but which to prevent the necessity of continual repairs led to the use of gutters for water along the edges of the roofs on stone buildings covered with stucco, which appeared unsuited for durability and compelled arrangements to palliate the difficulty mentioned.

Like the tiles, they were originally made of burned clay. The water from the roof was collected by them and at certain points, it was led far from the building by special outlets, so far as wind and weather permitted.

The continuance of the front side of the crowning water gutter on the inclined pediment cornices resulted more from reasons of form than of practice, although a safe ending of the

front row of tiles was required there. Indeed for this reason was it transferred to the marble temple and retained as a crowning ornament of the pediment, while it could be omitted along the sides on account of the goodness of the materials and because in storms and on high temple structures, the water spouts did not produce the favorable result desired. The clay water gutters had their firm and immovable bearing on the stone cornices, and they were most carefully connected lengthwise by the laps filled with fine mortar; they were constructed separately, as appears to have been the case on Temple C in Selinus (Fig. 351), or they were made in one piece with the drip tiles, the later usual method.

With the adoption of the stone (marble) tiles instead of the clay tiles for public or religious buildings, the clay cyma must also give place to the stone cyma. The form and oranmentation of the ancient clay cyma were then directly transferred to the stone cyma.(Compare the stone gutters of Himera and Akragas with the clay gutters of Selinus in Fig. 351).

243. Roof Sheathing.

According to the building contract of Puteoli, a separate sheathing was required on the rafters.("Operculaque abiegnea imponito."). The ceilings of Etruscan tombs frequently show the covering of tiles without sheathing, as already proved. (Also compare the sheathing at the Arsenal of Piraeus in the preceding volume of this Handbook. (2 nd Edition, Fig. 123).

244. Distance between Rafters.

The distance between two rafters was arranged according to the width of the tiles, where these were laid directly on the former. The lowest row of tiles must support the next, since laths and knob tiles have scarcely been proved to exist.

245. Tile Covering.

At the Temple on Egina, the tiles were held by iron pins, Which projected from the stone cornice; the Lex Puteolana requires them to be fastened to the facia on the rafters with iron nails; "tegulas primores omnes in antepagmento ferro figito."

The roof was usually covered with burned clay tiles of varied forms and dimensions; marbel or metal tiles (lead and bronze) were employed for magnificent buildings.

The frequently mentioned relief (Icaro ed Erigone) shows four kinds of roof tiles, which similarly reappear on sarcophaguses and ash chests, that imitated the form of houses or temples, whose originals were found among the ruins of almost all antique buildings on this side and beyond the Alps, and which are also to be seen in all museums of antiquities in abundance. (Fig. 352). There are flat curved, semicircular and gabled convex tiles, and flat or plane tiles with raised edges.

The oldest kind of covering was indeed that with slightly convex tiles, that were laid beside each other and were covered at the joints with convex tiles, as in Fig. 352 II, just like the mediaeval covering with "nuns" and "monks". These were supplanted by the better large form of plane tiles (tegulae [218]) with edges turned up at the sides and the conical or gabled convex covering tiles. (Imbrices [218]).

Note 218. Tegula = covering plate, roof tile. (Livy, Cicero). Imbrices = convex tile. (Pliny, Plautus).

A definite form appears to have been found soon for the latter, which was simple and easily produced, and it then remained in use in all countries, which the Romans held under control. Cunning caprices in the joining and covering, such as occur in Grecian marble tiles, are not found in the genuine Roman products.

246. Flat Tiles.

The tiles are sometimes rectangular, sometimes trapezoidal, or they are externally rectangular and then made trapezoidal within the margins; they have either recessed or merely undercut rebates (Fig. 353). The dimensions vary as much as those of bricks, as shown by the following sizes.

2.79 × 3.78 ft.	1.61 × 2.46 ft.	1.51 × 1.90 ft.
1.61 × 3.84	0.85 × 2.16	1.44 × 1.87
1.76 × 2.79	1.61 × 2.16	1.31 × 1.77
1.65 × 2.62	1.61 × 2.13	1.18 × 1.51
1.68 × 2.79	1.54 × 2.10	0.66 × 1.48
1.58 × 2.62	1.48 × 1.97	1.03 × 1.18
	1.51 × 1.94.	

The tiles in the tributary provinces are generally shorter and thicker than those in the mother country. Average dimensions of 1.18 × 1.51 ft. may be assumed for the former and 1.61

× 2.16 ft. for the latter.

247. Convex Tiles.

Convex tiles correspond in length to the flat tiles, are in the fewest cases exactly semicircular in cross section, but are mostly flatter with an internal dimater of 5.1 to 7.1 ins., and they are still more rarely of gabled form. (Fig. 354).

Many convex tiles show on the inner side vestiges of mortar, indicating that in many places they were set in a bed of mortar on the flat tiles. Knobs and nail holes are rare and scarcely occur.

248. Antefixas.

The lowest convex tiles of the roof courses are sometimes closed at the lower ends and are decorated by small figures, heads or palmatiums, thus forming an effective ornamentation of the drip cornice.(Fig. 355). This must further have been arranged for the better buildings. In the tiles found, the convex toles ornamented by antefixas form a very small proportion; in the tributary provinces, where fine buildings were reduced to the smallest number, they are very rare, which may support our statement. Likewise in Pompeii, they exist in small numbers.

249. Crest and Hip Tiles.

The two former kinds of tiles first sufficed for covering the plain surfaces of roofs, likewise for forming the ridges and hips of gable and hip roofs, if low walls were employed there, such as are commonly used in the South today (Fig. 356), as long as one desires to do without special hollow ridge and hip tiles. The rare occurrence of specially shaped ridge tiles causes their use to appear as neither general nor customary. They covered two courses of common tiles, and in the middle were set on the flat tiles. They were joined lengthwise by tongues projecting 1.18 to 1.97 ins., whose section is well conceived.(Fig. 357). The ridge received just as good or better protection by narrow gabled tiles with raised edges and grooves for the insertion of the flat tiles.

Examples found in Pompeii show vestiges of mortar on the joints; the convex tiles were therefore set in mortar. The convex tiles abutting on the ridge must have been shaped like the gabled tiles, overlapping on two sides, and were ornament-

ornamented at the crest with palmatiums, thus repeating on the crest the decoration of the eaves. (Fig. 367 [219]).

Note 219. Also compare the roof of the Temple on Egina (in the preceding volume of this Handbook; 2 nd. edition, Fig. 119); further the construction of the Temple of Nemesis at Rhamnus in Mauch, J.von. Die Architektonischen Ordnungen der Griechen und Römer. Plate 10. Berlin. 1875.

250. Valleys.

For roofs sloping inward for the compluvium, it was more difficult to keep the valleys tight, than the ridge and hips. This was most simply done by means of inserting concave tiles, as still employed on the houses of Italian peasants', but by this is obtained only a technically rude arrangement. The difficulties were obviated by another form of tiles, the lozenge tile slightly curved diagonally, with two angles cut off and two edges turned up. (Tegulae colliciarum). These permitted a perfect junction with the plane and convex tiles of the adjacent surfaces of the roofs and produced a tight and broad channel for water. These measure diagonally up to 3.18 and 3.55 ft. (Fig. 358).

No roof of modern times can compare with this tile roof, well conceived in all its parts and tested. [220]

Note 220. The recent excavations in Pompeii furnish conclusions in regard to the mode of covering roofs. Thus for example, "the partly and only for a time preserved" roof of the peristyle in the House of Siriaco (1852), now fallen and removed. -- A second better preserved and now completely restored roof is found in the House of C. Vibius in the right hand angle at the rear. (Compare Overbeck & Mau, p. 256, 257). -- "Roofs scarcely remain at all in Pompeii; better data are furnished by the excavations of Herculaneum" (Compare Zahn, W. Die Schönsten Ornamente und Merkwürdige Gemälde aus Pompeii, Herculaneum und Stabiae etc. Vol. 99, plates 63, 64, and text sheet. Berlin. 1828 - 1845). -- Yet Pompeii can also show the remains of two roofs, Niccolini, House of Lucretius, p. 17, and Strada Stabiana, House No. 57. p. 5. In the latter house, the roof of the kitchen remained; its tiles were provided with openings, through which the rain fell on other wide concave tiles set beneath them, by which it was collected and carried

off, while at the same time light was admitted. (Compare Marquardt, J. & Th. Mommsen. Handbuch der Römischen Altertümer. Part 1. p. 232. Leipzig. 1879.

251. Water Drips.

The flat and convex eave tiles do not differ on ordinary buildings, as today, from those covering the roof surfaces. But for richer or public buildings, we have seen that both flat and convex tiles of the eaves had special forms and ornamentation. Palmatiums adorned the fronts of the convex tiles; but they might likewise be placed on the flat tiles, when the convex tiles remained plain.

If the flat tiles projected beyond the edge of the cornice, then the underside of this projecting portion was decorated by painting. (See Fig. 347).

252. Roof Gutters.

The collection of the water from the roof in special water conductors or gutters, as the plastered Grecian-Sicilian limestone temples required, was soon transferred to the compluvium in the richer forms and treatment of the dwelling. The gathering of the descending water and its conduction to the ground at definite points must be recognized as a convenience, and it also had a better reason for the low height of the house and the enclosed location of the atrium, than for high temples- Even this arrangement was only provided on particular dwellings.

The collecting gutter might be unbroken and continuous, or it was divided for each (vertical) course of tiles. The former was in use for the Sicilian temples mentioned, being originally made of terra cotta, later of stone. It was necessarily composed of short pieces of either material, and to make it tight at the joints was a difficult problem.

We find careful and detailed tongued junctions, that are yet filled with mortar and strengthened by inserted metal cramps. This connection cannot be termed perfect; it cannot have produced a permanently tight joint, and it indeed required continual repairs.

The second method for collecting and removing the water from the roof is to be regarded as quite decidedly an advance from the former. The collecting gutter here consists of just as many and as wide boxes as the rows of tiles, which are separated

from each other by the upturned edges and the convex tiles. The convex tiles there project as far as possible and prevent the entrance of the water at the joints, though not perfectly.

Improvements followed in time, when the lowest convex tile was made of special shape; they curve over the joints of the gutter to its upper edge and end in a cap with a little head or with a projection to receive a palmatium, overlapping at right angles the abutting joints of the gutter boxes for their entire extent, but also completely covering them.(Pompeii). More certain protection cannot be found. The esthetically doubtful addition of the little head or of the palmatium on the margin of the cyma must then certainly be accepted therewith. (Compare Fig. 346; also the publications on the excavations on Samothrace and in Olympia).

We find the form of the drip gutter sometimes with a vertical front wall reccessed like an architrave and crowned by dentils and a small ogee moulding, sometimes curved like a cyma and finished with a band and moulded astragal, ornamented on the front by pipings, palmatiums or figures in relief and painting.(Fig. 354).

A simple drop tile with upturned margin of the gutter and a side opening for the discharge of water (Pompeii) is shown by Fig. 359 a; Fig. 359 b (from the Museum Nazionale in Naples) likewise represents a drip tile of the simplest kind; in Fig. 359 c, the front may be separately inserted in the groove, since we find similar arrangements in Fig. 359 e, d (Rome and Naples); but they may also have served on tiles enclosing a larger opening in the roof.

253. Spouts for Water.

For discharging the water from the continuous gutter and from the box gutters separated by the courses of tiles, the front wall was perforated and supplied with the so-called water spouts. This primitive mode of discharge might have remained in practice for thousands of years until almost the very latest period, before the discharge pipe finally presented a better connection of the roof qutter and the ground!

The water spouts are sometimes simple, open or closed on top, channels of rectangular or round cross section, brightly painted externally (Metapontum, Pompeii), or they are short pipes

with trumpet-like mouths (models in Athens, Olympia and Selinus) or the open mouths of lions, through which the water flows. (Akragas, Himera, Metapontum, etc.). Later and after the heads of lions had become typical, the heads of other animals followed as water spouts. Panthers, lynxes, wolves, dogs, dolphins and boars were employed, until at last the face masks of men came in the series.(Pompeii in Figs. 360, 361).

Instead of the head, apart of the entire animal form was also used. On the water spouting dolphin sits a little naked youth; from the edge of the gutter spring wolf hounds and lions, laying their fore-paws on tongue-like spouts, whose undersides are ornamented by the acanthus. The water ran through the spouts and the crouching beasts seemed to watch its flow. The masks have the widely opened mouth of the actor's mask; the projecting tongue was covered with thin plates of lead to protect the clay. With the great head of the wild boar (Pompeii) is joined the tense, though somewhat reduced fore-feet of the animal, giving the water spout the character of lurking and springing forth, such as the mediaeval gargoyles show again some centuries later. Corresponding to the channels, water spouts are placed in the angles of the atrium gutters, either directly in the right angle of the corner or on slabs projecting at 45 degrees, as shown by Fig. 362. Neither is there any uniformity of construction to a pattern here.

254. Ventilation and Lighting of Attic.

Ventilation and lighting of the attic could easily be arranged for gable roofs and shed roofs sloping to the exterior by means of openings in the gable walls. It was otherwise for shed roofs sloping inward and hip roofs, or when the gable was covered by figures or ornamentation. Here were required special roof openings (as today), which in form of the so-called hood tiles (Fig. 363) were arranged in the tile courses, or there were set ordinary flat tiles furnished with rectangular, circular, and spectacle openings, through which light came into the rooms in the ground story. The former afforded them protection by the cap against the entrance of rain; in the latter was probably set mica or cast glass to prevent the admission of water. An arrangement on a long roof tile in Pompeii permits the same conclusion with certainty.(Fig. 364).

No better arrangement could be conceived for a clay tile; the upturned border extending around it on three sides keeps the water from the glass plate, which runs down the row of tiles; this has a good bearing on the lower edge and by pins passed through the two holes in the projection of the support, it is held and fixed against the storm. The omission of the lower outer border makes possible the flow of water from the glass plate. There are glass plates 1.9 × 1.97 ft. in the local museum at Pompeii; therefore the assumption of such plates 0.69 × 2.62 ft. is permissible; furthermore, for the arrangement in question, two or three small glass plates overlapping each other might have been employed.

The hypaethras heretofore assumed as correct for roofs of temples certainly become far more probable in view of these very carefully conceived precautions against the obstruction of rain water on quite ordinary houses, which did not have to contain any sort of art treasures consecrated to the gods!

If ventilation rather than light was required in the attic, tiles with covered projections like chimney caps were used. (Fig. 363). These rose from the midst of the flat surface of the plane tiles, and they had 4 slits in the side walls with a dish-like ending at top.

Nothing was neglected in order to make the antique tile roof complete in every respect.

255. Marble Roofs.

From the Temple of the Sun in Rome have been preserved to us a great number of white marble tiles, that are now kept in the Tabularium. The flat tiles exhibit the same form as the simple Grecian marble tiles; the covering tiles are of gabled form with semicircular laps 3.15 ins. long. Workmen's marks (Latin letters) are found on the inclined surfaces of the covering tiles.(Fig. 365).

256. Metal Roofs.

The rapacity of mankind caused a brief existence of metal tiles on account of the costly material, when foreign races devastated Roman lands and the Roman religion declined. Constantius permitted the gilded bronze tiles to be removed from the Pantheon; we now know them only from descriptions. The same fate likewise befell the metal framework of the roof, one

one of whose trusses at least remained into the 17 th century, the form of which is still preserved in the drawings by Serlio and others; this is the bronze roof truss of the portico of the Pantheon in Rome (Fig. 366), removed in 1632.

It consisted of trusses, which comprised a tie-beam supported by two wall anchors and two principals rising above it. On these principals and on each side of the roof rested U-shaped purlins with a ridge purlin of like form, which received the rafters supporting the covering material.[221] There were 450,000 lbs. of metal obtained by this removal.

Note 221. Compare Normand. -- Also the very plausible reconstruction of the roof truss in Choisy, A. L'Art de Batir chez les Romaines. p. 155 and Fig. 199. Paris. 1873.

Likewise the 5-aisled Basilica Ulpia in Rome, built by Trajan, was covered by bronze (?) framework and on account of this construction, it was regarded by contemporaries as an architectural wonder. This really referred only to the bronze tiles.

257. Terrace Roofs.

According to Pliny (Book 36, 62), terrace (pavement) roofs were invented by the Greeks, and they must have maintained themselves only in such climates in which the rain did not freeze. The roof beams were covered with two crossed layers of boards only nailed fast at their ends, upon which was spread a layer of fern or chaff, on this being firmly tamped mortar one foot in thickness; this material was covered with a layer 6 fingers (4 ins.) thick, on which were laid large slabs not less than 2 fingers (1 1/2 ins.) thick, that were rubbed. The surface of the roof had a rise of 1 1/2 ins. to 10 ft.; Vitruvius (Book 7, 1) however required 2 ins. rise to 10 ft.

258. Vaulted Roofs.

As an example of a perfectly monumental roof, there is yet to be mentioned the vault rising above the cornice of a building. Roof and vault are there identical; a separate protecting roof over such a vault, as shown by later architectural periods, was not constructed by the Romans.

The external surface of the vault was covered with plaster or a coating, with metal plates or clay tiles, so that the forms of the vault and roof were the same, or vary slight changes were made in the former, such as were probably made for the

halls of baths covered by cross vaults and for vaulted basilicas.(See Fig. 343; also compare the Pantheon in Rome, various circular structures near Rome and Baiae, and houses in southern Italy).

Clay gutter tiles were used along the inclined gables of simple buildings, as proved by fragments found at Carnuntum. (Fig. 367 [222]).

Note 222. Also compare Der Römische Limes in Oesterreich. Part. IV, p. 14. Vienna. 1903.

259. Slate and Shingle Roofs.

Remains of roofs of slates and of wooden shingles are preserved for us on this side of the Alps, and which are proved by finds now exhibited in the Museum at Wiesbaden and on the Saalburg. Hexagonal dressed slates 1.15 ft. wide were employed, set according to Fig. 368 and fastened by nails (see the nial holes in Fig. 368). Wooden shingles were narrow and long, nailed four times, according to examples found on the Saalburg. (Fig. 368).

Chapter 7. Internal Architecture.

260. Floors.

The internal architecture comprises the construction of the floors, door and window closures, stairways, heating arrangements, and the decoration of ceilings and walls.

Wooden floors were not used for private or public buildings, not even being laid on the wooden beams in the upper stories. From ancient times were employed stone or mortar floors.

On the level ground, the earth was first tamped hard, then mortar was beaten solid with rammers, as implied by the name "pavimentum".(from "pavire" = to tamp hard). According to Vitruvius (Book 7, 1), the mass consisted of 1/4 lime and 3/4 gravel and was tamped with wooden rammers to a thickness of 9 ins. The facing layer was then composed of 3 parts of potsherds and 1 part lime, with a thickness of 6 ins., this being trued by straight edge and rubbed down, or on it was laid a floor of variously shaped or rectangular cut marble or clay tiles. Bricks were used for this, laid in the "Tiburtine" manner in herring-bone form. Marble dust was often sifted over them and a facing layer of lime and sand was applied.

The simple cement floor was later supplanted by the "lithostrata" from Greece, the floor laid with small stones. The first floor of this kind was executed at Rome in the year 149 B. C. in the Temple of Jupiter Capitoline (Pliny, Book 36,61); such floors are found to be already tolerably common 40 years later. Both ornamental patterns and also figure representations were found with the small stones, the latter being made so small in the advance of the art, and the gradation of colors so well chosen, that these little stone sketches equaled the most delicately painted pictures. Especially worthy of mention here is the mosaic of a Battle of Alexander found in the House of the Faun at Pompeii (Fig. 370), actually derived from that at Issos and dating from the 2 nd century B. C., being merely a copy of a famous picture of the time of Alexander the Great. Mau[223] terms it "an art work as wonderful for the ethical meaning of the representation as for the noble simple and yet effective composition, the characteristics of the different figures, and the certainty in the reproduction of the handling and of the expression."

For

For the simple mosaic floors in the Baths of Caracalla, the long bits of stone are set in a layer of pretty fine Puzzolano mortar 3.94 to 4.72 or even 7.08 ins. thick, from which they project 1.18 ins., and their sides are 0.39 to 0.59 in. (Fig. 369). The origin of these mosaics introduced from Greece is to be sought in the East. The Chaldeans were already masters in executing them 2500 B. C., and employed them both for floors and for walls. The Roman mosaicists called the works executed on walls and vaulted ceilings "musivum", those on floors were "tesselatum" and "vermiculatum." Small square stones were used for the tesselatum, while smaller stones of various forms were employed for vermiculatum. They were arranged unsymmetrically in curved lines, that followed the outlines of a figure, as is evident from Fig. 371, for example.

More important works of these two kinds are found outside Rome in Torre Annunziata, Palestrina, Nimes, Horkstow-Hill, Salzburg and Treves; then in various baths and private houses at Oued-Athmenia in Numidia (Baths of Pompeianus in 19 different rooms, magnificently executed during the Antonine period), further the House of Laberii in Oudna, others in Timgad, etc.[224]

Note 224. Compare Gauckler, L. La Mosaique Romaine en Afrique. Tour du Monde. p. 329 et seq. Paris. 1896.

The date of these mosaics is chiefly to be placed in the 2 nd century after the Christian era, that of the Grecian houses on Delos not later than 86 B. C., and that of Pompeian houses not after 79 A. D.

261. Mosaic of Clay Rods.

A plain example of mosaic of clay rods, composed of black, red and yellow hexagonal blocks 1.77 ins. high and 1.97 ins. diameter, was discovered in Street Bauerngasse at Mentz and is now to be found in the Roman-German Museum there -- a modest, but neat work (Fig. 372). A very simple pattern is composed of rectangular pieces of bricks 3.15 ins. thick, set in herring-bone fashion (opus spicatum), is preserved in the Museum Provincial at Treves and is represented in Fig. 373 c -- a design that has continued until our time as a pattern for floors.

262. Marble Slabs.

More complex patterns were executed in the houses of the weal-

wealthy and great with thin marble slabs of different colors and values. Examples are frequently preserved for us in Villa Hadrian near Tivoli (Fig. 373 a, b, d, e, f, g), which afford an idea of how far men were accustomed to go in form and color for these floor decorations, as well as in the selection of the materials.[225]

Note 225. Also compare Winnefeld, H. Villa des Hadrian bei Tivoli. Berlin. 1895.

263. Rough Floor.

The mosaic and slab floors required a special foundation, which was constructed in the following manner, according to the statements of Schwalb[226]:-- first a bed 3.15 to 3.94 ins. thick of concrete made of Pozzulana, sand, gravel and tile fragments, on which was a leveling layer of Pozzulana and sand, and lastly a bed of plaster of paris to receive the mosaic.

Note 226. In Schriften der Balkancommission. Antiq. Abth. II. Römische Villa in Pola. Vienna. 1902.

264. Closures of Doors and Windows.

As still found in the South, the doors in the interiors of the private houses were frequently replaced by portieres, yet not without exceptions; for in Pompeii in the House of Rufus, wooden doors (made by the joiner) are also shown to have existed in the internal rooms. Entrances to houses and to public buildings, temples, city gates, shops, and the gates to fenced grounds, etc., were closed by massive henged doors.

Vitruvius (Book 4, 6) distinguishes between Doric, Ionic and Attic doors, and he gives a general rule for the dimensions of the frame and panels. Then he speaks of removable doors, and doors with two and four leaves; by the latter are indeed to be understood two-fold doors for great public buildings, and that are also divided in height. Three and four-fold removable doors are shown to have been in various private houses in Pompeii.

Stone, wood, and metal, or wood covered with metal, were utilized as materials. Craftily obtained plaster casts of wooden doors in Pompeii have become known; in the Eumachia building and in the House of Sallust are preserved painted and blind doors; such were represented in relief on many stone sculptures and still exist. They exhibit the principle of the modern

door of joiner's work.

As shown by numerous vase paintings (see the Francois Vase in Fig. 32), the oldest wooden doors were made of boards and strengthened by cross and diagonal cleats. The joined boards were dowelled together, as shown by the ancient Egyptian cabinet in the Museum at Boulak (Fig. 374), a method remaining in use during the entire middle ages and that has continued until today in cabinet work of a similar nature.[227] A combination of the vertical boards into one surface by inserted dovetail cleats, such as occurs in mediaeval joinery (Fig. 275[228]), must not be similarly derived from antiquity. Butt joints or skew laps (Fig. 375) were like those today in the sheathing of metal or slate roofs. The joined boards were held better by the insertion of cleats grooved in (just as we still make our drawing boards), specimens of which on ancient Egyptian works we again have in the Museum at Boulak already mentioned (Fig. 374). The laps have the advantage, that in nailing on the cross cleats the nails must always pass through the wood, and that when the wood shrinks, it is impossible to see directly through the joints. Instead of butt and lap joints ocurred the rebated joint and that with tongue and groove, where both parts are formed in the wood by a plane, or the spline is made separately and is inserted in the worked grooves. The joint with rounded tongue and hollow was also used (Fig. 375). These technical methods were succeeded by framed work, where the surfaces of the doors were of varied thickness and were divided into panels by the frame and paneling. The panels are tongued and the frame is grooved, around it being fixed ogee, covering and border mouldings, just like the practice today for doors, wooden ceilings, windows, and furniture. We have proofs of all these methods by comparing plane bits, of which a sufficient number of specimens have been preserved in our museums.[229]

Note 227. Compare Viollet-le-Duc. Vol. 6, p. 348; Art. Menuiserie.

Note 228. Compare the same.

Note 229. Also compare Blümner, H. Technologie und Terminologie der Gewerbe und Künste bei Griechen und Römern. Vol. 2. p. 306. et seq. 1875. -- Further, Jacobi, L. Das Römercastell Saalburg bei Homburg v.d.H. p. 215. 1897.

When pieces of wood set flatwise were to be joined at right angles, dovetails were employed (Fig. 374), a connection already used in ancient Egypt and continued in all ages until the present.

For the larger buildings were employed wooden doors covered with metal plates, in which the system of framed construction was followed. This was repeated by the external covering in the subdivision and the system of ornamentation. The arrangement of the framework and panels increased the strength of the metal construction. The original wooden core was finally omitted, and for such works in metal was utilized the principle of hollow construction. The doors of Ss. Cosmo e Damiano and of the Pantheon in Rome (Fig. 376[230]) are yet splendid examples of this kind.

Note 230. Reproduced from Canina, L. Architettura Antica. Sect. III. Architettura Romana. Monumenti. Plate 45. Rome.1834.

As Fig. 376 gives a general representation of a door covered with bronze plates, there are shown in Figs. 377, 378 a, b, c, its construction and section, as well as a sketch of the beautiful rosettes and knobs, that decorated its framework. More nobly treated and delicately ornamented bronze rosettes serving for similar purposes will not easily be found elsewhere. Good is likewise the alternation of the simple hexagonal nail heads with the rich circular knobs, which permits the ornamentation to appear more effectively. Substitutes for the nails on the left hand leaf became necessary and bear the incised date of 1888, in order to quickly distinguish ancient nails from substitutes! (Always worthy of imitation).

Less rich and likewise faithfully imitating in its construction the framed work of a wooden door is the bronze door of the Heroum of Romulus and Remus at Rome (Fig. 379), the joints concealed by beaded astragals and the framework ornamented by rosettes alternately large and small.

265. Fastening Nails.

The nature of the fastenings of wooden parts -- nails of iron, copper and bronze -- is shown by Fig. 380. The common nail with flattened head, that with head moulded like a rosette, that with a hollow head and with edges bent up (like the so-called cross nail still used for ridges) were in use.

The principle of framed work was also transferred to the stone doors of tombs as well as those of the houses in the Hauran. The plain and smooth door leaf of a stone slab, which was already known to us on Etruscan tombs, received the same frame and panels as the doors of wood and of metal.(Fig.381).[231] Here likewise was the weight of the door lessened by thick framework and thinner panels without reducing its strength.[232]

Note 231. Reproduced from De Vogue, vol. 1.

Note 232. Compare the marble door of a tomb in Pompeii;-- further, Overbeck, p. 411, 507; finally, Semper, vol. 1, p. 366 - 369; vol. 2, p. 260.

In comparison with the doors, the shutters of the shops were somewhat rudely treated. In cities like Pompeii, as the casts show, they never exhibit the most refined work. They consist of a narrow door opening outward and a frame for the shutters, covered with boards. The shutters are held in grooves cut in the sill and lintel of the shop, only extending to the leaves of the door.[233] Similar grooves in sills for closures are likewise found in the gateways of Roman farm houses in Kanzler near Pforzheim, whose double doors were held at bottom by projections at the ends and at the centre of the sill(which did not obstruct the passage of a two-wheeled cart), and they could be made safe against being opened by a cross-bar placed inside them.

Note 233. Compare Overbeck, p. 378.

266. Windows.

The window openings were closed by cloth, wooden shutters, grilles of wood and metal, plates of glass, and by hinged leaves with glass, or in the Hauran by pivoted stone slabs (Fig. 382). The wooden shutters were cleated or framed like the doors. Framed shutters with two panels occur on a marble relief in the Uffizi at Florence.

Iron window grilles were made of flat and round iron and are in sufficient numbers in the local Museum at Pompeii and in the Museum Nazionale at Naples; richer grilles for closing larger openings or only extending breast high were of marble and of bronze, and these are preserved in the imperial palaces and baths in Rome and in the Museum at Naples.(Fig. 383).

The former use of wooden window frames in Pompeii is proved; (Fig. 384); metal frames with transom bars were rare in private

yet are found in them and in the baths.

Note 234. Compare Overbeck, p. 506.

The window sash in the earliest period was closed with oiled linen or with mica, well known as a protection from heat and frost (Pliny, Book 36, 45), later being filled with cast plates of glass. For smaller window openings, the glass plates were set without special preparation, i.e., were built in the masonry.

In the tepidarium of Villa Diomedes (Pompeii) was found a window (4.11 × 3.78 ft.), which contains in a wooden sash 4 glass lights 10.4 ins. square. In the smaller Baths of Pompeii, the large window (3.28 × 2.30 ft.) was closed by a single glass plate 0.51 in. thick, which was fastened in a bronze frame rotating on two pivots; the great window of the tepidarium there likewise had a bronze sash, in that of the House of the Faun [235] was also found a small window only partly filled with glass.

Note 235. Compare Overbeck, p. 204, 207, 350; further, Normand, p. 68; -- lastly, Mazois, F. Les Ruines de Pompeii. Vol. 2. Plate 2, p. 77. Paris. 1824 - 1838.

For metal sash, the glass plates were set in rebates or grooves and were fixed therein by movable bolts (Fig. 383). Ventilating windows in Pompeii were made with perforated clay plates. In the House of the Labyrinth, the clay plate filled the opening and was perforated by 6 semicircular holes. Further examples of perforated stone slabs for closing windows are given in Fig. 384 from Pola, Grado, Rome, and Bosra.

Beneath metal coverings, coats of color and costly paintings disappeared the woodwork of the joinery mentioned; common sorts of wood were covered with more costly kinds by means of the art of veneering and glueing.(Pliny, Book 84, 16;.Osiand. edit). Veneers of maple, beech, palmwood, oak, etc., ivory and tortoise-shell are mentioned by Pliny; he likewise speaks of Grecian, Campanian, and Sicilian kinds of joinery, of which we know nothing further. The joinings of the woodwork were indeed the same as are still preserved on Egyptian cabinet-work (Museum in Boulak), and which have remained the same until today. Mortises with wooden pins, dowelling, rebates and dovetails are executed in Egyptian woodwork, just as on the latest modern specimens of cabinet-making.(Fig. 374).

267. Door and Window Fixtures.

Door and window fastenings were made of bronze and of iron; those of the latter metal predominate in Pompeii. There were simple pivots (cardines), fixed to the leaves of the door and made of the same material, turning in holes sunk in the stone sill and lintel. On the marble door of the well known Tomb in Pompeii, the sockets and pivots were of bronze; a bronze handle served for moving the door; it was fastened by a bronze bolt and a lock opened by a key. Metal doors also rotated on pivots in holes; those of public buildings (temples) swung outward and those of private houses inward. These arrangements are such as we now make, aside from the materials, for great doors of courts and barns, or heavy metal doors.

The arrangements required for fastening, for closing, and for moving the leaves of doors may chiefly be recognized by the stone sill, where the building is wanting; thus for example in Pompeii, where various holes in the stone floor show us how the jambs and the wooden covering were placed and how the leaves of the door rotated about vertical pivots let into the sill and lintel. The latter were covered by cylindrical tubes of iron, or of bronze in the better houses, and rested in sockets of the same material. The door sills were frequently finished with a stop 3/4 inch high (Fig. 385), chiefly formed as a so-called rebate and not utilized for setting the jambs. Into the sills were let the metal sockets for the pivots; many of these still remain. In the sill are also found the holes for the bolts, which show us how many leaves the door had and their breadth. By the finds on the Saalburg were determined the following kinds of fixtures:--

1. Hinged and pin bands of bent iron plate, which were nailed on the leaf of the door, where the pins were fixed in the wall.

2. Head bands, perforated instead of with pins, which were nailed on the door jamb. This arrangement made it possible for the door to swing both ways.

3. Inlaid bands of plate like the modern bands.

4. Angle bands shaped like pins and pivots.

5. Hinge bands exactly corresponding to those in use today. 236

Note 236. See Jacobi, p. 240.

For wooden doors, especially for the smaller doors, the last mentioned hinge bands were in use to make them removable, numerous specimens of which have been preserved in Italy and in the tributary provinces.(Compare Museum in Palermo, Naples, Zurich, Avenches, etc.). They are mostly of metal and consist of two straps, which each have two holes at one end, through which is stuck a pin. Likewise hinge bands permitting the leaf to swing 180 degrees in one direction (for removable doors) have been preserved.(Fig. 386). Besides the hinge bands, metal corners were also in use to strengthen the angles or ornament them. These rather rudely made fixtures were fastened to the woodwork with nails; wood screws were not yet known; at least none have yet been proved.

The leaves of the doors were first fastened by the bolts (pessuli) entering the sill and lintel. This fastening was aided by cross bars (sera), for which holes were cut in the door jambs at the right and left, or by oblique props, projecting stones or holes for them appearing in the pavement, or both methods were employed at the same time.

The primitive fastening by wooden bars and bolts, that could only be released on the inside, was succeeded by enclosed locks, which could be opened from the outside by a key. They were mostly made of iron as now; yet in the House of the Great Mosaic at Pompeii were also found silver-plated door locks and bronze fixtures with relief ornaments.

Existing locks are greatly corroded by rust, so that their construction cannot be determined in detail without further information. The key consisted of wards, barrel and bow, like our own, and served to raise or shoot a bolt. Sliding and pressure springs for fastening the bolt did not occur in the case, neither levers nor pins. The signal for opening was given to the doorkeeper by the knocker fastened at the middle of the leaf of the door.

Among the fixtures for fastening are mentioned fixed and hinged locks of metal, and such exist from the Roman period in sufficient numbers. Even sliding, rotating and hinged locks were distinguished. Wooden, Carian, and Laconican keys are mentioned. A wooden lock still common in north Africa dates from the earliest period and was also in use by the Romans; it

is described by Marquardt and Mommsen[237] as follows:-- "A wooden bolt is 14 to 24 ins. long, and passes through a rectangular case above it and on the exterior of the door, and when the door is single, it enters a hole in the masonry. The bolt itself has 5 holes on its upper side, which lie beneath the case when the bolt is shot, into which slip 5 pins from the upper part of the case in order to fasten the bolt. But this is hollowed out for half its depth. Into this hole is passed a wooden key in the form of a thick rod with 5 iron pins corresponding to the 5 holes in the bolt. When these are pressed upwards into the holes in the bolt, the loose pins are raised and the bolt is withdrawn.

Note 237. Vol. 7, p. 226 - 230.

More interesting than this is the wheel-lock of the antique bronze doors of Ss. Cosma e Damiano in Rome.(Fig. 386). The bolt of this is toothed and is moved back and forth by a pinion turned by an inserted key. The idea of the modern espagnolette bolt and of bolt locks is already apparent here. A very interesting example of a flush leveling bolt for a door, remarkable for its refined treatment in form, is the example found in Pompeii ind illustrated in Fig. 387, on which the mechanical arrangements are good and are easily recognized; likewise the large key of a house door also shown in Fig. 387 and also found in Pompeii may be regarded as a characteristic example of such.[238]

Note 238. Also compare Mazois, Vol. 2. Plate 7.

Investigations of later date in regard to Roman locks were made by Chubb.[239] An essay by Nötling[240] is not an antiquarian study, but merely a description of models of locks made by the author himself, which are exhibited in the Antiquarium in Mannheim.

Note 239. Chubb, J. On the Construction of Locks and Keys. London. 1850.

Note 240. Nötling, E. Studie über altrömische Tür- und Kastenschlosses, etc. Mannheim. 1870.

Wooden and iron locks of similar construction were found on the Saalburg. Models of these were made by Jacobi in Homburg v. d. H. for sale.[241]

Note 241. Also compare Cohausen, von; Die Schlösser und Schlüssel der Römer. Annal. des Verein für Nass. Alter. 1874. 13. p. 135.; further, especially Jacobi, L. Das Römercastell

Saalburg bei Homburg v. d. H. Homburg. 1897. Figs. 73 - 76; Die Entwickelung des Verschlusses von der einfachen Schnürr aus Holzgeflecht (Weide) bis zum Metallschloss der Römer. p. 464, 469, 473, 477; Comparison of locks and keys, in which it is stated, that the hollow key is the oldest form of the rotating key. -- Compare further the metal fixtures from the Museum at Aquileia in Fig. 388.(From drawings by the author.).

Self-closing doors, which were necessary in the Baths (compare the small Bath in Pompeii), were similarly arranged by the inclined position of the door jambs. Then in opening them, the door leaf must be raised, and when released, this fell back into its original position by its own weight.

The window leaves swung on pivots like the doors (compare the round windows of the small Baths in Pompeii) and they were indeed fastened by bolts.

It may also be mentioned here, that for wooden chests or boxes perforated bones (bone tubes) were employed as hinges.

268. Stairways.

Stairways for public buildings, temples, basilicas, amphitheatres, etc., were built of stone blocks as massive flights of steps or great stairs with landings and straight flights, like the stylobate of the Grecian temple.[242] The steps then rested on vaulted substructures oron solid masonry, thus always having a secure support.

Note 242. Compare Part II, Vol. 1 (2 nd edit. Art. 52, p. 73) of this "Handbook."

Reduced to very moderate dimensions, we find them as service or workmen's stairs in temples and basilicas, as winding stairways in rectangular and circular spaces, with and without landings, with prismatic or cylindrical newells, built of ashlars or of bricks. As well preserved examples of both kinds may serve the winding stairs in Temple Concordia and Temple Juno in Akragas (both of these indeed belong to Grecian buildings on Sicilian soil); further those of Basilica Maxentius in Rome. At the former, the intermediate and enclosing masonry with each three steps, or two steps and a landing, is cut from a single block; at the latter are set tiles obliquely against the enclosing wall and the newell, in stepped form, the steps being built in above them.(Fig. 389).

269. Winding Stairways.

We find the winding stairs in a circular stairway in the Palace Imperial in Treves, constructed of projecting courses of bricks with four courses forming the risers, which turn around a newell of bricks and ashlars 4.26 ft. in diameter, and the treads are 2.79 ft. wide. The risers are 11.0 to 12.2 ins. high with treads averaging 13.8 ins. wide. The flights are broken by landings; but yet the stairs are inconvenient to use on account of their high risers and narrow treads. The bricks used measure 14.2 × 14.2 × 1.57 ins.; the mortar joints have a thickness of 1.57 ins., equal to that of the bricks. Winding stairs in circular spaces are also indicated in the Palace of Constantine at Arles, further in the spiral columns of the Emperors (column Antonine and Column Trajan at Rome), others in rectangular spaces with division walls in the various triumphal arches (Arch Severus, Arch Constantine), at the Pantheon, a and again in a circular space in the Tomb Church of the daughter of Constantine the Great, etc.

The winding stairway in a circular space with a masonry newell appears to be characteristic of the period of Constantine. (Basilica Maxentius, Palaces in Arles and Treves, Tomb-Church near S. Agnese outside Rome). The Baths of Caracalla exhibit stairways in circular and rectangular spaces, of which Fig. 390 gives a plan; four landings and short flights with only 3 or 6 steps between them.

In the Hauran could also be built stairs with self-supporting flights with the excellent stone as a material; these frequently lead on the exteriors of dwellings to the upper stories or the terraced roof, like the peasants' houses in southern Italy. Artistically treated stairs between the stories and staircases, antique art seems to have chiefly employed only in palaces or great public buildings.(Figs. 391, 392).

According to Figs. 390 (plan A) and 391 (view of a stairway on the Palatine and in Baths of Caracalla at Rome), the stairways with a landing and in two flights particularly come under consideration here, with widths over 6.56 ft. The flights are then separated by division walls and are spanned by inclined tunnel vaults, while the landings are covered by cross vaults, -- an arrangement that the good period of the Renaissance in

Italy again adopted in the same structural and formal treatment.(Compare Scala d' Oro in Palace Doge at Venice). What remains of the stairways mentioned is indeed only in ruins, but it is still of such importance, that one is not compelled to accept anything problematical with it. That these stairs were finished similarly as in Roman buildings is proved by a portion of a staircase wall in Palace Imperial at Rome (Fig. 392), where the wall surfaces above the treads are covered by costly and richly moulded marble work.

We find stairway construction highly developed in the theatres and especially in the amphitheatres in all places in the Roman empire. The stairs are mostly wide but are always steep, which lead to the ranges of seats, and which are either built of separate steps resting on the inclined tunnel vaults, or two steps are cut from a single block, as in Arles.(Fig. 393).

270. Stairways in Three Flights.

Stairways in three flights were built at the Colosseum in Rome, as may still be plainly seen by the vestiges in place and from Desgodetz' drawings. Canina restores therefrom such a three branched stairway as represented in Fig. 394.

The stairways in the great city apartment houses for rental, which were built to the height of 69 ft., must have received a good architectural treatment just as little as their exteriors. Steep wooden stairs, steep as a ladder, inconvenient, awkward and without risers, connected the stories. Vitruvius (Book 9, Preface, 8) indeed requires the stairs to ascend rather gently; for he desires to have the triangle composed of the inclined stair horses, of their horizontal projection, and of the height of the story, to be formed according to the numbers 5, 4 and 3, the 3 being assigned to the height of story.

In Pompeii, in the houses and also in some public buildings, the stairs were indeed constructed of stone, but most were of wood, only the first step being of stone. The latter is frequently the evidence of the former existence of the wooden stairs destroyed by fire.[243]

Note 243. Also compare Overbeck, p. 506; -- further, Nissen, p. 602.

271. Wainscoting on Walls.

The walls and ceilings of interiors were chiefly covered by

with plastering (compare Vitruvius, Book 7, 2 - 55 further, Art. 187) and this was ornamented by painting. Stucco cornices clearly separated the wall and ceiling from each other. According to the purpose of the room, Vitruvius (Book 7, 3) requires the latter to be sometimes plain, sometimes decorated. In rooms with places for fires or where many lights were burned, they should be left plain; in summer apartments and in exedras, where smoke and soot could do no injury, they might be ornamented. He accordingly likewise rejects a rich treatment and decoration of vaulted ceilings in winter dining rooms.

The method employed for the mural paintings in Pompeii (and what is true for Pompeii must likewise be assumed for the remainder of Italy) was chiefly painting in fresco, according to the investigations of the painter Otto Donner, both for the plain cold grounds, ornaments and figures, as well as for the pictures within borders. This method in fresco predominated; colors mixed with size and tempera painting was on the contrary quite subordinate and appears to have only been employed as subsidiary. Encaustic painting was not used at all.

The colors employed were inorganic with few exceptions, mineral -- the same which modern fresco painting has long used.

Some few examples in Pompeii afford proof, that finished pictures were also painted on separate slabs of stucco, then being inserted in the walls.

It is to be stated here, that for all repeated ornamentation, whether executed in relief or merely painted, stencils were very seldom employed; execution with a free hand was the rule.

But instead of plastering and painting, it may also be concluded from Vitruvius (Book 7, 4), that on the walls were used wooden wainscoting to a certain height, also a veneering of marble slabs, mosaics and mosaic ornamentation (for glass mosaic, compare Art. 260), metal plates, and intarsias on ceilings and doors.

272. Heating.

Special arrangements for warming living rooms were less necessary in the southern climate. As still continues today, men were satisfied there with charcoal braziers on especially disagreeable days. These were made of bronze in all sizes (7.00 × 2.53 ft. in Pompeii), and they consisted of a grate of bronze

bars standing on feet with a vertical enclosure of metal. On the grate were laid bricks with pumice stone thereon, upon which glowing charcoal was then heaped. The bronze vase was not fixed to the floor or wall, but it was movable and could be transferred to any desired place.

Even in the warm baths, this arrangement was still used in addition to the hypocaust. But for large rooms and if a high temperature was required therein, it must be regarded as unsuitable. It might be considered as supplanted, when at the beginning of the last century B.C., the hollow floor was invented by Sergius Orata, and with this the walls were lined with hollow tiles (tubuli) or hook and knob tiles (tegulae hamatae and mammatae).

Through the cavities beneath the floor and in the walls the hot air from a furnace was allowed to enter and pass; the largest apartment was thereby warmed in a better and more uniform manner than at present. This system of heating was transferred from the baths to the living rooms, and the latter were provided with the same arrangement; it became necessary when the question of the thorough warming of a room became more important, especially in a northern climate. Nearly all Roman settlements on this side of the Alps were supplied with it, as shown by the still existing remains in villas, palaces, and farm houses.(Sinsheim, Messkirch, Pforzheim, Treves, etc.).

The apparatus consists of the furnace (praefurnium) or fire-place proper and the hypocaust (hypocausis), to which a flue leads as directly as possible, with which the hollow tiles of the wall are connected. Vitruvius (Book 5, 10) requires the floor of the hypocaust to be constructed of flat tiles with a fall towards the furnace. From this should rise small square brick piers built with hair mortar, with sides of 0.79 ft., 1.97 ft. high and standing 1.97 ft. apart, which are covered by two layers of flat tiles 1.97 ft. square, and that support the floor. Instead of the square piers, we also find cylindrical, and they are also made of sandstone instead of bricks, with equal height and bearing areas, though they were cut smaller at the middle; the piers are likewise only 1.48 ft. high in many places, and instead of a tile floor in the hypocaust, we also find concrete floors. Otherwise the requirements of

Vitruvius are everywhere followed.

The fuel doubtless conssisted of weel burned charcoal, that produced heat abundantly but no smoke; for the heating flues, the brick piers, the ceiling supported by them, or the interiors of the hollow tiles are not everywhere found to be blackened by smoke or soot. The latter are not always in direct connection with the heated space beneath the floor; on the contrary, they were connected together by openings in their sides. They were doubtless so closed again at top, so that the gases only escaped at certain points into the open air through conducting flues. If a fuel producing soot had been chosen, the walls of the hollow tiles would soon have become well covered with it, and the circulation of the heated air would have been obstructed or prevented; since a great portion of these clay tubes were not accessible from below, to clean them became an impossibility.

The conservative South is poor in wood and today uses in a given case, for example in furnaces, charcoal by preference and not fire-wood.[244]

Note 244. Compare thereon Overbeck; further, Schmidt,Ch.W. Baudenkmale der Römischen Periode und des Mittelalters in Trier. Lief. 2. p. 22, 23. Treves. 1889.

The hollow tiles were set in mortar against the outer walls, and some were fastened to them by iron cramps. (Compare the Baths at the foot of the Palatine in Rome, in Pompeii, in Fiesole, in Treves, and in other places).

Ventilation was provided by openings, that could be closed (by metal disks hanging on chains, according to Vitruvius, Book 5, 10, the close), by hollow tiles passing through the vaults (Palace Imperial in Treves), or by masonry air flues; Examples of the latter are very carefully built of flat tiles and bricks and are still preserved in the Baths of Caracalla at Rome.(Fig. 395, 7).

By the same furnaces, besides the hypocaust, was also heated the bath water in great cylindrical vessels (7.20 ft. in diameter). This method of installing them made it possible for a single furnace in one of the Baths in Pompeii to perform the heating of the air and of the water.(compare the small Baths in Pompeii and Fig. 396; also see Chapter 22:-- Baths).

a. That the hypocausts without wall heating must have chimney flues or similar arrangements to produce an air current, which carries off the gases of combustion.

b. That for hypocausts with wall heating, the knob tiles fulfil this purpose and may act as chimney flues.

273. Central Heating.

Both statements are justified by the conditions. On the Saalburg were planned direct passages of the smoke through the flues,[247] (Fig. 397); two such are found in the caldarium of the so-called Women's Bath of the Stabian Baths. Round smoke pipes 7.9 ins. diameter are there not carried vertically above the roof, but extended over the ceiling vaults and opened at the side beneath the roof.

Note 247. Compare the Essay of Jacobi on the arrangement of chimney flues and baths in the Women's Bath of the Stabian Baths in Pompeii in Duhn, F. von, and L. Jacobi. Der Griechische Tempel in Pompeii. Heidelberg. 1890.

274. Kitchen and Industrial Arrangements.

For kitchen hearths with open fires, the smoke escaped into the room itself, rose to the ceiling or roof and was conducted through openings in the tiles or chimney caps into the open air.

For industrial fires, the smoke flues were built in the wall, the pipes ending at a certain height, and the smoke then escaping as for kitchen fires.

Besides these arrangements, we further find openings in the floors for admitting heated air, distributed to the rooms, and which could be made large or small by sliding plates, by means of which a regulation of the temperature was possible. When the furnace was red-hot, fresh air was permitted to pass through it, and it could be introduced into the rooms as warmed fresh air as it might be needed.[248]

Note 248. Also compare in this sense the mediaeval heating arrangements, for example those in the Monastery of Maulbronn.

A heating arrangement with ventilation added was installed on the Saalburg; the fresh air could be admitted through an opening placed at right angles with the axis of the furnace, as made apparent in Fig. 397.

At the January session of the Archaeological Society in Berlin in 1903,[249] the antique heating arrangements were described by Graf on the basis of Krell's work,[250] which appeared at that

The heating of the ordinary masonry hearth of the kitchen likewise occurred by charcoal, as well as for the little portable bronze hearth, the oven for warming the food, the basins with water tanks and the baking ovens being heated with charcoal. One of these in the House of Sallust at Pompeii was even found with the addition of a chimney flue,[245] though a rare and unknown example in Pompeii, while chimney flues also occur in private houses (for example, Reg. VII, Inf. 12), in which they consist of hollow clay tiles.

Note 245. Compare Overbeck. Illustration on p. 385.

The Balnae pensiles of the Orata and the covering of the walls with hollow tiles or those with knobs and projections, which yet occur in the period of the republic, appear to be the so-called enclosed heating arrangement, where the heat from the fuel passes upwards and is moderately radiated. The smoke and gases of combustion were separately conducted t through these, thereby not causing impurity of the air in the heated rooms.

The hot air of the furnace passed beneath the floor to the hollow tiles or to the hollow space between the wall and the knob tiles. At the buildings of the Camp of Carnuntum,[246] the following forms of heating were distinguished:--

1. The epicaust, or the heating arrangement above the floor in the form of a bench along the wall as a channel for hot air, covered by tiles.

2. The hypocaust without wall heating. On account of the omission of the latter, the former was not fixed at a definite place, and it might just as well be at the centre as beside or along the wall.

3. The hypocaust with wall heating, where the hot air flue must extend along the wall (Fig. 397, where knob tiles were employed for covering the flue). We find the piers of the hypocaust here constructed of hollow square tiles and of two joined hollow tiles.(Fig. 397).

On the Saalburg was found a heating arrangement in which the hypocaust and heating flues were combined together (Fig. 397), and a true flue heating system has been made known to us by the excavations at Silchester.(Fig. 398).

It is to be stated in reference to these methods:--

time, when in reference to the work of Baumeister mentioned below,[251] the complaint was made, that little had been done for a thorough investigation of the ancient heating arrangements from the technical and professional side. With regard to the work mentioned, this may be justified, but not otherwise.[252] Graf states that according to a later opinion based on Vitruvius, it has been believed, that "the floor and the surface (sic) of the hollow walls were heated by the gases of combustion of the furnace, and by their means the air of the room was warmed." But this view was proved incorrect by Krell's work, and the conclusion there developed is both novel and unassailable; the rooms were warmed by means of charcoal braziers and the hypocausts chiefly served, not for heating, but for keeping the rooms dry; The floors were also never heated to that degree, that their upper surfaces should serve as a stove, and that in nowise were the hollow tiles filled with hot gases for heating the rooms.

Note 249. See the Report of session 26 for the year 1901-2. page 25.

Note 250. Krell, O. Altrömische Heizungen. Munich. 1902.

Note 251. Baumeister, A. Denkmäler des Klassischen Altertums. Munich & Leipzig. 1885 - 1889.

Note 252. For example, compare the bibliography in Daremberg & Saglio, part 24, p. 346, and the appended essay with illustrations.

To these statements are opposed the facts, especially those of the Rhine-Danube frontier, for example in the extensive Baths near Castle Niederberg, that were built at a considerable height above the Rhine and thus in a perfectly unrestricted and dry location. The hypocaust was there free from the earth and covered with shining soot. When uncovered, there streamed into the room a penetrating odor of the products of distillation of wood. The walls of this bath room were covered with hollow tiles, held by iron T-cramps. All the objects found indicated that these heating arrangements had been for a long time in severe use. Sooty hollow tiles are also shown in Wiesbaden; such were previously mentioned at the Museum Emperor Augustus at Basle. Likewise in the hypocausts of Marienfels has been found a great quantity of soot. The hypocausts

could be entered by small boys (like out little sweeps, as Theodenat says) and be cleaned.

Krell's assertion, that likewise in the North, men were satisfied to heat a room of ordinary size by a charcoal brazier with the dimensions of a plate, and that its use was in nowise dangerous to health, each person may test on his own body, who is interested in the matter. I still remember from the year 1866, that in Rome the cafes, restaurants, barber shops and the like were warmed by open charcoal braziers with an external temperature of + 25 to 30 Fah., and that men and women used clay charcoal braziers (scaldini) for warming their bodies. These were somewhat larger than soup plates and at the market or at work, the women placed them under their dresses, or carried them in their arms when looking out of the window, when they were covered by a handkerchief hung about the neck. No one died in the cafes from the charcoal gas; but the carbonic acid gas produced by the charcoal braziers made a stay there unbearable, and we were frequently compelled to rather freeze in an overcoat in a cold room, than to go from a room warmed by charcoal braziers with a heavy head unfit for work. Were the distinguished Romans, who were accustomed to every luxury in life, less sensitive on this point?

In the summer of 1903, rooms were completely restored on the Saalburg with hypocausts and the wall coverings and the heating system was actually used. Jacobi invited me in a very friendly manner to visitand observe this. The external temperature in the morning was 61 1/4 degrees Fah.; the room to be warmed had a floor area 13.6 × 16.0 ft. and a height of 10.1 ft. In the furnace was gradually placed and set on fire 132 lbs. of charcoal covering about 10.76 sq. ft. After the expiration of 24 hours, the room showed a temperature of 90.5 degrees Fah.; walls and floor felt like those of a well heated stove of tiles. Some of the hollow tiles extended above the wall and were left open to the attic, by which the heat required for the draft could escape above the ceiling through the openings of the rafter cornice into the open air without any particular chimney flue.

It is now not to be denied, that hypocausts and hollow tiles might also have been constructed to keep the room dry, thus a protection against ascending dampness, the water used there-

therein, and dampness occurring externally or internally; but the hollow spaces then required the passage of dry and warmed air, if the arrangement was to be effecient.

276. Damp Walls and Floors.

A simpler means for attaining this -- dry walls -- is given by Vitruvius in his Book 7, chapter 7.(Plastering on damp walls). He requires either double walls or a covering of the walls with hollow tiles coated with pitch. With this is to be a flue extending beneath these and with pipe openings to the exterior, under the concrete floor and with air holes above; for if the moisture does not have an escape both through the openings below and above, then will it no less spread in the new masonry."(i.e., that covered by tiles).

For keeping the floors dry, gutters or Swiss channels were employed, such as occur on the Saalburg[253].(Jacobi, p. 175). In the natural earth were dug trenches with a fall, which were again filled with stones so laid, that the water could easily flow through them and run off at the lowest point. Always the cheapest and simplest method, if the conditions of the floor permitted it. The systems mentioned were in use; they are proved by the written evidence of Vitruvius and of the constructions on the Saalburg. It was desired to keep the surfaces of the walls and floors dry, and they indeed resorted sooner to these expedients instead of hypocausts and tile flues, that further required costly measures, if they were to act properly. Therefore why term these arrangements for drying, when other, simpler and in part better means were current? Let men leave to the hypocausts and tile flues their intended purpose as arrangements for heating the interiors of rooms!

277. Heating of Rented Houses.

How the heating of the rented barracks of 6 or 7 stories in the great cities was done is hard to say now. Hypocausts and hollow tiles were there impossible. On the ground floor was the merchant with his warerooms or the artizan with his workshop, and in the upper stories dwelt the poor devils. The scaldino or hot brazier must help them; its charcoal fire produced by little smoke and soot. As still frequently in Italy today, both found their way into the open air through the win-

window or through a pipe in the wall, or masonry smoke flues above the roof carried them away far above the heads of the occupants.

278. Privies.

To conclude from the precedents in Pompeii, the other cities of Italy must have been indeed supplied with public and private privies.(Latrinae). In Pompeii, such were to be found in the building of the Eumachia, in the Baths, in the Theatre, in the Forum Civile, even with water drainage in the latter place. In the dwellings, they were either in the vicinity of the bath room, or chiefly near the kitchen. They were closed by special doors, frequently arranged with two seats, even being large and nobly decorated, lighted by windows and holes for light. (For public privies, see chapter 14. Works for Water Supply etc.).

Chapter 8. Tools and Scaffolds; Nature of Constructions; Estimates of Cost and Building Contracts; Status of Architects; Artists' Fees and Art Criticism; Architectural Models; Building Laws.

279. Workmen's Tools.

If we glance at the tools required for architectural structures, we find a remarkable similarity between those very ancient and those employed today, especially in the South.

This resemblance can always be proved by paintings (Pompeii), by reliefs (Column of Trajan and Tombs in Roome), and by actually existing examples.(Pompeii, Naples, Saalberg, Mentz, and very many other places). Likewise the Egyptian museums (Boulak), where a great number of Egyptian reliefs afford data and give evidence, how conservative the artizans in all periods have been in reference to their tools. Axes and hammers, stonecutters' mallets and chisels, trowels and mortar trays, are the same as several thousand years since. Squares, lines, compasses, folding rules, straight-edges and plumbs, joiners' tools, such as saws, handsaws, planes, borers, etc., were in use and were made pretty nearly like our own. Bronze, iron, wood and bone were used in making them.

280. Lifting Machines.

For handling ashlars, we find iron crowbars and cant-hooks, for raising them are the lewis, consisting of two wedges and a flat piece with a bolt passing through them (Pompeii), also great sling ropes, which were sunk in U-shaped grooves or rebates of the ashlars, rollers and pulleys, the windlass, the lever and the treadwheel as motor machines, the scoop-wheel, the spiral-wheel, etc.254

Note 254. Compare Vitruvius, Book 10, 1-11;-- further, the well known relief in Museum Lateran in Fig. 399; -- Further, Overbeck, p. 460 - 461; then Blümner, p. 193 - 208, 215, 220 - 227, 342 - 344; lastly, Durm, J. Polychrome und Constructive Details der Griechische Baukunst. Plates 11, 13; p. 14, 15; also Figs. 191, 192.

For transportinm large columns, Vitruvius (Book 10) recommends to fix them as an axle between wagon wheels 12 ft. high or to roll them like road rollers.

281. Scaffolds.

281. Scaffolds.

The erection of great vaulted structures alone presupposes a scientific and secure use of building scaffolds of all kinds, and judging from Egyptian reliefs, we must consider them for large buildings as consisting of pole scaffolds (composed of vertical poles, plates and putlogs), as well arranged as the best of our own time.

The Rhine bridge of Caesar and the Danube bridge of Trajan, which were built of straight timbers and planked arches, permit the Romans to be recognized as masters in carpentry work. 255

Note 255. Compare Fröhner, W. La Colonne Trajan etc. Vol. 4. Plate 129. Paris. 1872 - 1874.

282. Quality of Execution.

As already stated, the quality of the work is generally excellent for all the larger structures; it does not always keep pace with either the development or the decadence of the artistic forms, for we likewise owe even to the period of decadence much, that is beautiful and technically perfect in construction. From the beginning to the end, it remained a principle in ashlar masonry, both for the vertical external or division walls as well as for the vaults; the most careful coursing, dressing and jointing of the beds and ends of the ashlars, the avoiding of mortar, but the aid of iron or wood for the closer connection of the different parts.

We likewise find in brickwork the most careful coursing with materials as true and thin as possible with mortar joints not too thick. In the best structures of this kind, the latter is to the thickness of the bricks as 1 to 3 or 1 to 4 (Amphitheatre Castrense in Rome), or 1 to 6 (Sedia del Diavolo near Rome). In the later period the mortar joints were made of the same thickness as the bricks, and the mortar joints were frequently thicker than the bricks in walls faced with smaller or different materials.

In spite of this careful structural arrangement and the mastery attained by the numerous and great structures, curvatures of horizontal lines are proved to exist on Roman monuments, as 256
well as on Grecian, mediaeval (Compare the Cathedral in Pisa) and on works of the Renaissance. (Palaces Farnese and Farnesina in Rome and countless others), and on those of the most recent

period (everywhere), although the latter have not always been shaken by earthquakes and explosions of powder, and they are just as little intentional or based on an over refined theory as in Rome or elsewhere.

Note 256. Rohault de Fleury, G. Les Monuments de Pise au Moyen Age. Plate 12. Line of the small materials -- which exhibits the same curvature as the horizontal lines of the Theseion. Paris. 1864.

The curvatures are neither useful nor injurious in fixing the artistic worth of an architectural work; at most they rather injure it, if the eye does not recognize them; the enjoyment of a monument, whether in ruins or new, at least to the author, is not heightened by their existence.

Märtens[257] rejects the well known discussions concerning the curvatures of horizontal lines, entirely useless to every practical architect -- and that have only caused mischief -- to which we shall not add a page here, since the views of the author on this point were stated in the preceding volume of this "Handbook", and in spite of recent objections, he has no reason for departing from his earlier statements. For theorists, scholastics and fanciful persons, this will always remain a welcome them for discussion.

Note 257. In Der Optische Massstab. 2 nd edit. Berlin. 1884.

283. Estimates of Cost and Building Contracts.

Estimates of cost and building contracts were recognized and made out, the latter being frequently carried into all details, an interesting example of which is preserved in the well known Lex Puteolana.

That besides the architect, others had an oversight of the estimates of cost, is shown by Vitruvius (Book 10, preface), where he assigns to them a definite function. He terms it "a hard but not unjust law", when in Ephesus the practitioner was held responsible with his property (if he possessed so much) for an excess of cost of more than 25 per cent over the estimates. In undertaking a building, security for its completion must be given with his property. If the estimate of cost had not been exceeded, then he was honored by decree and by distinctions; excess up to 25 per cent was paid by the state and no further punishment was given.

284. Esteem for Architecture among the Arts.

The indispensable necessity and the importance of architecture in the practical domain of public and private life were the reasons, why it was regarded as the most respectable among the arts, and why it was placed equal to the art of healing by Cicero, since not merely in Rome but in all great cities, it was that one affording the greatest returns.[258] It was therefore more thronged, and not only slaves, freedmen and foreigners, but even Roman citizens were numbered with its practitioners during the republic and in the entire imperial period. (Vitruvius under Augustus; Apollodorus of Damascus under Trajan; Severus and Celer under Nero; Rabirius under Domitian; Decrianus under Hadrian; Costumius Rufinus built the Temple of Zeus in Pergamon; Cossutius completed the Temple of Zeus at Athens, etc.). The activity of the architect required the employment of all kinds of artists; nowhere arose a building, for whose ornamentation were not likewise utilized the sculptor, stucco-worker, chaser, statuary, bronze-founder, painter, and the mosaicist. Statues filled the pediments, niches and intercolumniations of the temples; the basilicas, theatres, and the baths (the Theatre of Scaurus alone could show 3000 bronze statues); triumphal and memorial arches, etc., were animated and enriched by them; likewise the palaces, villas, parks and gardens never lacked sculptured ornamentation. House utensils and furniture were included within the circle of art work; Herculaneum and Pompeii appear only as an average measure of the artistic decoration of the cities in Italy. "The poorest dwelling more frequently lacked the necessary house equipment than artistic ornamentation."[259] And yet the historical position of the artists remained a subordinate one with few exceptions, whether this was from the low estimation of art by the Romans. Of what use was indeed the Crotan Milo to men, because he was never overthrown (Vitruvius) -- or Apollodorus, because he furnished the most beautiful architectural designs to his imperial master? And yet, as previously stated, architecture remained the only art creatively handled by the Roman, as one allied to his national talents."

Note 258. Compare Friedlander, L. Darstellungen aus der Sittengeschichte Roms in der Zeit von Augustus bis zum Ausgang der Antonine. 6 th edit. Part 3. p. 302. Leipzig. 1890.

Note 259. Compare in the frequently mentioned work of Friedlander, Juvenal's description of the contrivances of a miserably poor author.

Seneca sees in the artist merely an artizan; "while men pray to the statues of the gods, they despise their makers."

One reason for the low estimation of the formative arts was the exclusive and excessive esteem of the literary and rhetorical culture. Lucian represents in his dream sculpture as an uncultured woman, rude, dirty and with callous hands -- the art of oratory as a splendid contrast, so that even Polycletos and Phidias themselves must appear to those amazed by their works as being merely selfish artizans.

The great emperor Marcus Aurelius Antoninus was likewise the[260] author of very striking expressions in his Meditations concerning the praise and blame of art works:--"Everything beautiful, of whatever kind it may be, is beautiful in and for itself; it is completed in itself, and praise forms no part of its nature. Praise makes an object neither worse nor better. What has been said is true of everything termed beautiful in ordinary life, as for example, of the products of nature and of art. Whatever is truly beautiful needs no praise, any more than law, any more than truth, any more than kindness or decency. How could it first become good through praise or bad by blame? Does the emerald lose in its value if not extolled? Likewise gold, ivory, purple, a lyre, a sword, a flower or a shrub?"

Note 260. Book IV. 20.

285. Claims.

The modern view of art may take to heart these words of the emperor, and which by its manufactories and series of helpers makes the art work an article of commerce and of the artist an artizan deceived by itself. But the imperial master also speaks the same, when he says[261] (Book "9, 16):--"For an expression of praise by the populace is nothing more than babble. Therefore let thy bit of fame pass. But what remains really worthy of consideration? It seems to me thus:-- to show thyself active and judicious in accordance with thy particular natural qualifications. And likewise proceed the industries and the arts. For each art has its purpose, to adapt its products to the end for which they are produced." Are these gold-

golden words always obeyed by artists?,Repeated -- indeed, but followed in the rarest cases, which is true to this hour!

286. Artists' Fees.

Friedlander[262] (p. 297) says in reference to the remuneration of artists, that we know little about this, and he gives a few well known examples, from which it is evident, that the commissions thus paid were not small, even if the value of money at that time were not assumed to be higher than at present. They were as high or higher than those of many of the most prominent artists of the 18 th and 19 th centuries.

Lucullus ordered from the sculptor Arcesilaus a bust of the goddess Felicitas for $2621, and Zenodorus received from the city of the Averni (Clermont) for the execution of a colossal Mercury $2175 annually for a period of ten years.

287. Architectural Models.

Now occurs the question:-- how did the Roman architects work out their designs, The model must take the place of drawings in by far the more numerous cases.

From the periods of the Gothic and of the Renaissance in Italy, models are in evidence; but the drawings on parchment and paper continue at the same time and play the greatest part, if we except the large wooden models in Bologna, Florence, Pavia, and for S. Peter's in Rome. Gypsum, cork and wood were chiefly the materials for their construction. The material for the pregothic period are scarce; but von Schlosser[263] has been able to prove, that the thread of tradition extends back into the antique period, and that the architectural model was as common then, as with the masters of the quattrocento period.

Note 263. In Beiträge für Kunstgeschichte aus den Schriftquellen des frühen Mittelalters. Sitzungsberichte der Wiener Akademie, Phil. Hist. Classe. LXIII. Abt. 2, 36. et seq.

In the Annual of the Austrian Archaeological Institute, Benndorf[264, 265] undertook in an intelligent manner an investigation to show the continuity of this art method in even an early antiquity. Coins and reliefs as well as original specimens were adduced, and Benndorf gives such in the essay just mentioned. We see on antique coins the forms of monarchs or of local deities, which hold in their hands the models of temples or houses of the deity, analagous to the Byzantine,

Mediaeval, and also Renaissance representations on sculptures and reliefs (Fig. 400). The marble fragment of the model of a building with four Ionic columns wrought free was found by the Austrian commission in the Agora not far from the harbor of Ephesus. But the best conception of such an architectural model is afforded by a marble relief in Museum Nazionale at Rome, which shows the scene of a theatre with the three doorways and six niches with columns, pediments and the protecting roof with coffers.(Figs. 401, 402[266]).

Note 264. Reproduced from Benndorf, O. Antike Baumodelle. Jahrb. d. Oest. Arch. Inst. Vol. 5. (1902).

Note 265. The same. Vol. 5. p. 175 - 195.

Note 266. In reference to building materials, cost of building, wages and building superintendence, also compare the preceding volume of this "Handbook".(2 nd edit. p. 300 et seq).

288. Building Laws.

The Roman building laws,[267] which are of a public protective character, follow three tendencies.

a. Methods of construction for lessening danger from fire.

b. In the interest of small cities, to prevent the removal of ornamental objects.

c. To require the rebuilding of fallen structures.

Note 267. Compare Voigt, M. Die Römische Baugesetze. Report of Proceedings of Royal Saxon Gesellschaft der Wissenschaften at Leipzig. Phil. Hist. Classe. Vol. 5. 1903. V.

a. The regulations concerning the danger from fire were first directed against its extension by the use of too frequently employed wooden construction in the erection of dwellings, by the arrangement of wooden posts in division walls, by the placing of front balconies (maeniana) extending over the street, by certain arrangements in shops and stores, by narrow and irregular streets, by the easily combustible materials covering the roofs, and finally by the insufficient means of putting out fires. Augustus improved the matter by the introduction of a special fire guard (vigiles nocturni). After the burning of Rome for ten days, the Lex Neronis relating to the mode of constructing cities was published on July 19, 64 A. D., which:--

1. Again renewed the Lex Julia, according to which the great-

greatest height of the houses might not exceed 70 feet.

2. Required the isolation of houses built new and the abolition of the common fire walls.

3. Increased the space between houres ti twice its width, i.e., to 10 feet.

4. Required a free space to be left on each piece of ground.

5. Prescribed a veranda on the front of each house, from the flat roof of which men might pass to overcome the fire in the upper story; rewards were aussured to the occupants of houses, who provided themselves with apparatus for extinguishing fires.

Constantine the Great removed all private housese adjoining the treasury buildings and fixed their distance from the granaries at 100 feet. An edict of Zeno in constantinople determined the distance of new buildings from adjoining lots of the ground at 12 feet, the construction of the front balconies to be of stone instead of wood.

The Roman house in the earliest period was covered by shingles (scandulae). after the burning of the city by the Gauls, (365 A.U.C.), came the roofing with flat and cover tiles (tegulae and Imbrices), and in 470 this mode of covering roofs was prescribed by law.

Special laws against high dwellings were issued under Augustus, which fixed their maximum height at 70 Roman feet = 68.39 feet. We may here assume six stories and a ground story, the story being taken at 8.2 ft. Houses extending above the legal height must be torn down. Trajan fixed the height of dwellings at 60 Roman feet = 58.25 ft.

The dwelling of the antique period was required to have a space of 5 ft. at each side, for which each owner must leave 2 1/2 ft. From the second half of the 3 rd century B. C., on account of the great increase in the population of the city, this space was omitted and the common fire wall was introduced instead. According to "very ancient traditional methods of building", the foundations of the facade walls (caementicius paries) were constructed of rough stones (lapides); to these succeeded the story walls (latericius paries) of air dried bricks (lateres crudi). The latter had a length of 1.46 ft. and a width of 0.97 ft. A brick of these dimensions was termed "lidius". The length of the brick equalled the thickness of

the walls of one-story houses in both ground story and attic. For houses of several stories, the walls were built 2, 3, or 4 1/2 bricks thick -- paries diplinthus or triplinthus --; the following gradations were preferred.

First at bottom the stone masonry -- paries caementicius.

This was followed by brick masonry -- Paries testacius.

Then the half-timber wall -- paries craticus.

In the second half of the 6 th century A. U. C. appeared a law, which forbade the erection of houses with walls 2 or 3 bricks thick as well as party walls. This decree again restricted the height of dwellings.

Under Valentinian (368 A.D.), wooden balconies were again forbidden for new buildings and old wooden ones were to be torn down.

b. Hadrian issued an edict against the removal of ornamental parts from dwellings, that forbade the removal or transfer of ornamental objects from houses. Constantine the Great went still further, who forbade the removal of ornamental monuments in a city to another city or to a country estate. The "protection of monuments" is therefore no invention of the modern period.

c. If the owner of land did not rebuild his fallen or destroyed house within a prescribed period, then according to an edict issued by Vespasian, any one might appropriate the site of the building, who would undertake that duty.

C. TREATMENT AND DEVELOPMENT IN FORMS OF ARCHITECTURAL MEMBERS.

"Besides this ancient Italian art tradition and the early predominance, that Hellenic culture obtained over the taste of the Italic races, as a third factor, that aided in producing the architectural style of the later world-dominating Rome, there is to be designated the direct Egyptian-Asiatic influences upon customs, mode of life, and the art of the Romans, shortly before and during their universal dominion ----. The Romans, in their faithfully preserved Indogermanic art traditions were still half Asiatic, and they found themselves more at home in the Egyptian provinces than the Greeks, and they solved the problem of the combination of Asiatic-Egyptian and European motives into a generally prevailing architecture of the world!"

Semper. Der Stil. Vol. 1. p. 479 - 505. Frankfort. 1860.

289. Preliminary Remarks.

Ancient Italian, Tuscan, Grecian and Egyptian-Asiatic elements and influences are visible on Roman buildings and occur successively beside each other and intermingled. Different periods in the treatment of forms are accordingly to be distinguished, as well for their art, to which reference has already been made, and which are frequently determinative in the building materials employed. They are comprised in the four following periods.

1. The period of the early republic.
2. The time of the triumph over the states of Southern Italy, Greece, Egypt, and of Asia, which had advanced further in civilization and were characterized by greater wealth.
3. That of the settled monarchy of the world under Augustus and his successors.
4. That of the greatest wealth and luxury, of extravagance, and of corruption.

The architectural forms of the first period were still based on the Greco-Italian and were employed by Etruscan artists; they are distinguished by plain, delicately membered and purely designed details, as well as by retaining white in the use of ornaments. The grayish-green peperine, the rarer travertine, and air-dried bricks, which were covered by plaster, ter-

terra cotta and color, are the prevailing building materials. (compare the Sarcophagus of Scipio Barbatus, the Tabularium in Rome, and the Temple of Hercules in Cori).

Those of the second period are under the influence of masters from southern Italy and eastern Greece, but do not bear the perfected Roman stamp. As materials still predominated tufa with a covering of plaster, travertine, air-dried and burned bricks (Compare Temple Fortuna Virilis and Theatre of Marcellus in Rome).

The architectural forms of the third period exhibit the completed blending of Italian and Grecian methods, a richer ornamentation and a beautiful harmony of details; instead of tufa with a perishable coating of painted stucco, there were employed firm kinds of stone of many colors and in part noble, with carefully shaped and burned terra cotta.(compare Colosseum, Temple Mars Ultor, Temple Vesta, Temple Antonine and Faustina, as well as that of the so-called Deus Rediculus in Rome).

Those of the fourth are distinguished by the overloading of the members with ornaments become already very flat, by the overabundance of detail forms, labored motives, and a bombastic style of ornamentation with an intended wealth of materials. (Compare the buildings in Baalbec, Palmyra and Spalato). The variegated and costly material kills the form.

The Greco-Italian columnar construction is already adopted in the structures of the first period, and it is retained in all those succeeding this. No building is designed without it, whether it now extends freely before the enclosing walls, or in the form of half or three-quarter columns is combined with them into a whole of one or of several stories. The series of forms of the treatment of columns is in all periods equally rich as in Grecian art; it was soon extended by retaining the ancient Italian or Tuscan form of column and by the addition of the Composite order and its derivatives. To the Doric, Ionic and corinthian orders were thus added the Tuscan and Composite orders.

Besides the columns, piers are very commonly employed as free supports in the most varied forms, as well as the human figure as caryatids -- female or male forms supporting burdens.

In the first period must have been preferred the native Tus-

Tuscan order, although as shown by Etruscan rock-cut tombs, supports with volute capitals were likewise current with the architects of the period.

The perfected Grecian Doric order with its related parts might have been unable to finally supplant the native one mentioned; for examples of its use scarcely exist. Its present non-existence does not exclude an earlier use; a later time may have dispensed with it. In reference to this may be mentioned the Doric colonnade of the Tabularium, the Tomb of Hamath[268] in the Hauran, the portico of Forum Triangulare in Pompeii and others.(Fig. 493). What Vitruvius states in regard to the proportions of the Doric order is far better suited to its treatment in the developed Roman period than to the Grecian proportions. Even if Grecian requirements are frequently accepted, for example in the frequently occurring omission of the base, then again all other parts of the column are Tuscan.[269] (Compare the columns of three temples in S. Nicole in Carcere, of Theatre of Marcellus, of Baths of Diocletian, etc.).

Note 268. Compare De Vogue. Plate 1.

Note 269. In Reber, F. Die Ruinen Roms etc. 2 nd edit. p. 208. Leipzig. 1879.

In the succeeding periods, after the effeminate Ionic order had attained no real success, the rich Corinthian and Composite orders, the latter being ornamented by figure, trophy and fanciful capitals of every kind, won the supremacy over all others and became predominant in Roman architecture. Only for buildings of several stories were the simpler orders permanently employed, when with correct understanding, the architect applied the bold Tuscan to the lower, the softer Ionic to the middle, and the luxuriant Corinthian to the upper story. Yet this rule likewise has its exceptions.

Chapter 9. Tuscan -Doric Order.

290. Column.

The Grecian - Doric column, "one of the highest products of man's appreciation of form," did not require the base as an earth-borne force. "The profile of the echinus of the capital is the most important indication of strength, the ground tone of the whole."[270] (Burckhardt). It is otherwise with the Roman or Tuscan Doric; this consists of base, shaft and capital, or merely of the two parts last named, according to the predominance of Etruscan or Hellenic influence, or later according to the taste of the architect.

291. Base.

The base frequently shrinks into a narrow pand with apophyge, but it also consists of a square plinth and a bold torus resting thereon with fillet and apophyge; it likewise frequently imitates the Attic base with or without plinth, or instead of the scotia, the cyma occurs as the transitional or combining member.(Fig. 408). The height of the base is less or equal to the lower radius of the shaft.

292. Shaft.

Vitruvius requires the shaft to be diminished, as for the Ionic column, and to have an entasis, which accords with most of the executed examples.

According to him, the surface should be animated by 20 flat or concave flutes, which only accords with some structures, since for example, the shafts in the Baths of Diocletian have 24 flutes and others again are left plain (Theatre of Marcellus, Colosseum, Mousmieh, etc.), while yet others are but partially fluted, or flat and concave bands together cover the shaft, the former occupying the lower third, while the upper two-thirds are animated by shallow flutes of segmental form. (Temple in Cori, Tabularium in Rome).

According to the same authority, the diameter of the shaft, i.e., its lower diameter, in both the Tuscan and Doric orders is to the height as 1 to 7 (this including base and capital), which again only approximately accords with the erected structures, as shown by the following numerical ratios.

In Albano	1 to 7.50
Theatre of Marcellus	1 to 7.78
Baths of Diocletian	1 to 8.00

Amphitheatre in Nimes	1 to 8.60
Colosseum in Rome	1 to 9.30
Amphitheatre in Capua	1 to10.00

The desire for greater slenderness is manifested everywhere.

293. Capital.

The capital usually consists of a square abacus, that is surrounded by an ornamental member at its upper edge, of the echinus with the annulets, and of the necking; the latter is not emphasized on all works.

For the Doric and Tuscan capitals, Vitruvius requires the height to equal the lower radius, which is to be subdivided into three equal portions for the three parts just mentioned. This rule fits in the fewest cases. The height of the capital is almost invariably greater than the lower radius of the column; on the Colosseum and in Capua, it is even larger than the lower diameter of the column.

The echinus is generally formed as a quarter-round, but in accordance with the Tuscan model it gives place to the cyma, (Fig. 404), and in one case is ornamented by recurved ovate leaves, which extend upwards in another. Even the smaller ornamental members are then mostly adorned by foliage, beads and bands, the necking being beset with rosettes, the underside of the triangular corner, which shows in placing the square abacus on the annular echinus, is emphasized by border and rosette ornament.

In this ornamentation of the principal and decorative members, whose proportions are frequently delicately balanced, this capital excels in beauty and distinguished simplicity the Grecian Doric in all its parts and in general effect.(Fig. 405, which comes from the Regia at Rome and is perfectly beautiful).

A similarly beautiful capital was made known by Canina, but it spreads somewhat too much. a quite similar provincial work is shown by the capital from Regensburg and the two corresponding bases in Fig. 406, A, B, D.

294. Pier and Pilaster.

We likewise find the pier as a free support, more richly subdivided by half columns and pilasters in some cases; as the ending of the angle of a wall besides the pilasters on the wall and at the angle. Forms of capitals and bases, as well as the

proportions of the height, are for the latter the same as for the columns, if they do not even surpass them in slenderness, as for example, on the Amphitheatre in Verona, where the height of the pilaster including the base course amounts to from 11.5 to 12 times the diameter. Any diminution of the pilaster is generally omitted, the upper and lower widths being equal to each other.

Since the shafts chiefly consist of coursed ashlars, then in many places (Pola, Verona, etc.), the roughly wrought stones are so left in setting, only the base and capital being completed with the mouldings and in the previous forms. The dressing of the coursed ashlars is not everywhere completed, and the projection originally intended as a smooth pilaster with delicately profiled capital now exists as a rusticated pilaster with moulded capital; these were thoughtlessly adopted in the Renaissance as they were, since in their veneration of the antique, men at first imitated its works without criticism. The incomplete was accepted as perfected, and this has incontestably for us and for certain buildings added its own charm, or even decidedly increased the effect of bold simplicity.

295. Entablature.

The entablature consists of the architrave, the triglyph frieze and the geison. Proportions and forms of these parts essentially differ from the Hellenic.

While for the latter, the architrave and frieze are of almost equal heights and are nearly equal to the lower diameter of the column, or are at least 2/3 of the same, Vitruvius requires for the Doric architrave, including the band, only the radius of the column as its height, the triglyph frieze being one-half higher than it, which accords with most structures; for the ratio of the lower diameter of the column to the height of the architrave is, for example:--

In Albano	1 to 0.50
Theatre of Marcellus	1 to 0.51
Baths of Diocletian	1 to 0.53

And in all three cases the triglyph frieze, including head band, is one-half higher than the architrave, whose height always remains equal to the upper diameter of the column.

296. Architrave.

After Hellenic models, the architrave in the two first periods is entirely smooth on its face and is ornamented by a head band, from which and corresponding to the triglyphs, the regulas and drops are suspended. It is later subdivided into several bands and is more richly treated with decorative mouldings; the head band is also returned beneath all triglyphs, since the latter project beyond the plane of the architrave.(Compare Baths of Dicoletian and the Order in Albano; also Fig. 404).

297. Frieze.

The frieze is composed of triglyphs and metopes, whose distribution and arrangement depend upon the intercolumniations, or conversely, the latter are based on the former.

On the earlier monuments, the triglyph frieze and the intercolumniations resulting therefrom were arranged according to the Hellenic manner (Cori), while Vitruvius' rule is later followed everywhere, which requires half metopes at the angles; "for by these are obviated all difficulties, both of the metopes as well as of the intercolumniations and of the underside of the cornice, since the divisions are made equal.[271] Over the end intercolumniations are required 1 triglyph and 2 metopes, with 2 triglyphs and 3 metopes over the middle one; on account of the angle triglyphs and the smallness of the frieze in Cori, 3 triglyphs and 4 metopes are placed over each intercolumniation.

Note 271. Compare the preceding volume of this "Handbook," (2 nd edit. p. 126).

The width of the triglyphs is equal to the lower radius of the column and corresponds to both the rules of Vitruvius as well as to the structures, and likewise the square form of the metopes also.

The channels of the triglyphs are not always carried down to the base (Fig. 407; Albano), while their ends lack the Grecian scotias. Instead of the intersections at top, the uniform chamfer is characteristic, as on the vertical splays. The head band is returned around the triglyphs and is continued at the same height over the metopes, which are either left plain or are ornamented by pateras, rosettes, or ox-skulls and garlands. (Fig. 407).

298. Cornice.

298. Cornice.

"Over the head band of the triglyphs rises the main cornice, (geison, corona), first with an ogee Doric moulding and a second beneath, projecting 2/3 and with a height of 1 1/2 module," says Vitruvius. Since according to him, the diameter of the column is 2 modules, the cornice indeed would be ratter thin, if 1/2 the radius of the column were taken as its height and 2/3 as its projection. The structures generally show with the ogee Doric moulding a height of more than a half diameter of the column and a projection of 2/3 diameter, or more.

Corresponding to the triglyphs and the centres of the metopes, Vitruvius requires for each obliquely suspended mutules with an arrangement of 6 × 3 = 18 drops, separated by plain intermediate parts, or those with thunderbolts. Even this condition is fulfilled in the fewest cases, for the mutules frequently project horizontally instead of obliquely, and they are also beset with 6 × 6 = 36 drops, which are not always set on projecting plates but are frequently in panels sunken like coffers, or the mutules and their appurtenances are entirely wanting, and a cornice of refined Ionic form covers the building.(Figs. 408, 409).

On a fragment of cornice, that probably belonged to the Regia on Forum Romanum, in order to lessen the work necessary, an effect of relief is good and is produced by cutting only half way around the 16 external drops, while the 20 inner ones are indicated by a projection of 1/8 inch.(Fig. 410,a). On the Memorial Arch of Augustus at Aosta, the but slightly projecting drops are placed in the sunken under surface of the cornice slab. To each triglyph corresponds a group of drops,and a lozenge-shaped shield to each plain metope.(Fig. 410, b).

It is also worthy of mention, that for the earlier buildings dentils are introduced in the main cornice above the triglyphs (Sarcophagus of Scipio Barbatus, Ttheatre of Marcellus), after Greco-Italian or Etruscan models, and which have been preserved in many ancient Sicilian works. (Compare Fig. 409, which represents the cornice of a terra cotta well (puteale) in Syracuse).

Chapter 10. Ionic Order.

299. Column; Base.

The Ionic architectural system stands in strong contrast to the Doric. "Roman imitations with all magnificence yet produce only a dry and petrified phantom of the form feeling and the movement of the Grecian model." Its works are rare, the best are only preserved in fragments, good examples thereof on the theatres and amphitheatres and on the little Temple of the so-called Fortuna Virilis in Rome, very much mutilated on the small rectangular Temple in Tivoli, unfortunate ones in the internal colonnade of the Temple Jupiter at Pompeii -- with which we can become acquainted and can compare it with the traditions of Vitruvius.

The column, "a more tender nature," consists of base, shaft and capital; the former is imitated from the Attic and is usually furnished with a plinth. Vitruvius (Book 3, 5) prescribes for this the radius of the column as its height, which agrees with the works, as well as the width of the plinth at 1 1/2 diameters of the column.(Fig. 413).

300. Shaft.

The shaft is diminished and is furnished with an entasis; it is in accordance with the material employed left smooth, or it is ornamented by 24 flutes of semicircular form, that are separated by broad fillets. The diminution amounts to from 1/7 to 1/6 the lower diameter, which has to the entire height of the column, including capital and base, the ratio of 1 to 8.50 or of 1 to 9.00.

301. Capital.

The capital is imitated from the Grecian form; it also repeats all the peculiarities of the Grecian, which result from the different modes of placing the columns. With volutes on 4 sides, further adapted for peripteral locations and with Hellenic taste, we find it on the buildings of Pompeii; likewise ornamented by ascending palm leaves on the junctions of the volutes, with flowers and scrolls on the bolsters and the 272
volute bands, as on the capitals of Solunto, Sardes, etc. With volutes on two sides and peculiar capital for the angle column, with projecting angle volute and half volutes in the reentrant angle, they are found on most monuments of Rome.

Note 272. Compare the preceding volume of this "Handbook". (2 nd edit. p. 252, Fig. 174). -- Further, Mazois, F. Les Ruines de Pompeii. Vol. 3. Plate 20. Paris. 1824.

Beautiful and recalling the Grecian simplicity of the good period are the capitals of the Theatre of Marcellus and on the little Temple Fortuna Virilis.(Fig. 411). The volutes indeed no longer show the elastic Grecian lines and the refined doubled border: they are joined by the horizonta, band and appear somewhat inert, but they remain free from all caprice. Following models from Asia Minor and Attica (Miletus, Priene, the little Temple of Nike and the Temple on Illissus in Athens), they lack a necking member and thus produce a stumpy impression. A fixed formula was created for the spiral, according to which it could be drawn with the aid of the compasses;[273] the course of the volutes no longer remained in a plane; one was permitted to pass over the other, even if but moderately so, to project to the most strongly projecting eye.(Fig. 411; the plan of the capital). The bolster was ornamented by sedge or acanthus leaves, which extended to right and left of the dividing round to the border of the volute.

Note 273. Methods of drawing it are given by D'Aviler, Goldmann, Palladio and Vignola.

A beautiful fancy of this kind of Ionic capital is afforded by that represented in Fig. 412, found in Rome, which exhibits Grecian form treatment in details. Ionic bastard capitals are on the 8 columns of the so-called Temple of Saturn in Rome, with 4 projecting volutes and a triple echinus.

Variations of the Ionic capitals were published by Canina (Sez.999, Pl. 68), of which that one with little figures in t the eyes of the volutes deserves to be emphasized.

To the later period belong the forms in which the channels of the volutes are entirely filled with foliage, and little beads are inserted instead of the rosette eyes of the volutes, and which are repeated on the middle of the abacus band.(Figs. 414, 415). These are intique pieces, which were also later employed on the columns of the Early Christian S. Maria in Trastavere at Rome. A remarkably beautiful representation of the Ionic column is given by Fig. 413, as it may be seen today on the Theatre of Marcellus.

The volutes on the capital in Fig. 416 are of peculiar form, which more strongly recall the Corinthian helices and do not terminate in an eye, but in a projecting scroll ending in a point. According to the precedent of the Corinthian capital, the abacus is curved inward on all four sides. Without previous example is the shield tablet beneath the astragal on the shaft of the column and bearing the name inscription. The interesting example comes from the rich Museum of Antiquities at Aquileia, which contains so many beautiful things.[274]

Note 274. According to friendly information from Professor Domascewski in Heidelberg, the inscription on the tablet is doubtless of the period of the republic, indeed from the middle of the 1 st century B. C. It has at last been printed by Dessau: Inscriptiones Latinae Selectae. Vol. 2. No. 2992. Berlin. 1902. There is another example, which has been misplaced from Aquileia to Peroga near Padua. (Compare Dessau. No. 2998).

On account of its painting is the column of special value to us, represented in Fig. 417[275] and from the peristyle of House of the Colored Capitals at Pompeii. The base is painted red. the lower plain third of the shaft is yellow, and the fluted upper two-thirds is painted white; the volute channels are blue, their sides are yellow, as well as the small leaves on which rest the beads, and likewise the head fillet above the cyma. This capital belongs to the kind of those, which admit of the peripteral arrangement without change, thus having the volutes curved outward on all four sides.

Note 275. From a drawing of G. Damiani-Almeyda in Palermo.

302. Anta and Pier.

Antes and pilasters are composed of base, shaft and capital, like the columns. The base exhibits the same mouldings as that of the column; the surface of the shaft remains plain or is fluted. the capital is like that of the corresponding column and either has curved volutes or volutes and bolsters; the cyma is always gently curved out and projects somewhat beyond the surface of the shaft.(Fig. 418). Syrian monuments mostly retain the Hellenic projecting volutes.

While Grecian art invented for the antes and pilasters (compare Erectheum, Temple Nike Apteros) a special form of capital

differing from the volute capital, the Roman was satisfied in a not entirely perfected manner by transforming the latter as directly as possible to the plane face of the wall or to the angle pillar.

303. Spacing the Columns.

Vitruvius requires (Book 3, 5) the columns to be inclined, "so that the inner side next the cell wall should be vertical, while the entire diminution should appear on the outer side. For thus would the external design of the temple be executed in accordance with a correct law of diminution." But this principle is not found to be obeyed in the few existing Ionic buildings; even the Greeks are well known to have made no use of it for the Ionic order, while they only partially applied it to the Doric,[276] since for example, the columns of Sicilian temples are constructed of drums with entirely parallel surfaces.

Note 276. See the preceding volume of this "Handbook". (2d edit. p. 94).

The members of the base and capital should not be horizontal, according to Vitruvius, and the filling between them and the horizontal stylobate and architrave must be formed by a fillet (scamilli impares) of unequal height -- which is nowhere proved.(Fig. 419).

304. Architrave.

The architrave has two, or as a rule, three bands, is capped by an ogee moulding and fillet, and it is generally as high or somewhat higher than the lower radius of the column and of the same width as the upper diameter of the column.

All members above the capitals of the columns; architrave, frieze, tympanum, acroterias, etc., Vitruvius would have inclined forward by about 1/12 their height,"so that they appear vertical to the view and to stand square." At the Theatre of Marcellus, the bands of the architrave are inclined outward; they are vertical on other buildings and again are inclined backward on yet others.(Fig. 420). The bands are sometimes separated by beaded astragals, the surfaces are generally left plain, but they are also ornamented by fret scrolls, (Figs. 421, 422; Temple of Victory in Suleim), for example in late Syrian buildings, the crowning moulding being either plain or decorated by heart leaves.

305. Frieze.

The frieze is generally lower than the architrave, whether ornamented by sculptures or not; its face is either vertical or convex, but is never inclined forward.(Fig. 422).

Vitruvius would make the frieze adorned by reliefs 1/4 higher, which does not agree with the Temple Fortuna Virilis, and the plain one 1/4 less than the architrave.

306. Cornice.

The main cornice is imitated from the Grecian of the same order as a dentil cornice with undercut geison and a rising cyma, that is sometimes ornamented with the ascending acanthus and beset by lions' heads. Vitruvius prescribes for the dentils a ratio of width to height of 1 to 2, the width of the intervals to be 2/3 that of the solid, a projection equal to the height and also equal to the middle band of the architrave, which agrees in many cases. The greatest projection of the main cornice to pe equal to its height: "for all projections that have an equal projection and height have a pleasing appearance" -- a principle that everywhere accords with the buildings.(Fig. 423).

307. Tympanum.

The tympanum lies in the same vertical plane as the lower band of the architrave, which indeed could only have been the case with the plain tympanum, while for that adorned by figures, it was set back, just as on Grecian works.[277]

Note 277. Compare the preceding volume of this "Handbook." (2 nd edit. p. 154).

The height of the pediment, Vitruvius would have equal to the ninth part of the fillet of the cornice, measured from one end to the other, the angle acroterias being as high as the tympanum at the centre and the apex acroteria 1/8 higher than those. In such manner the pediment becomes rather low and corresponds more to Grecian than to Roman structures, while the acroterias, consisting of figures in this case, would appear rather large.

According to Vitruvius, dentils should be omitted on pediment cornices; "for the ancients did not approve of them." Nevertheless the Syrian Andronikos (100 B. C.) employed them on the pediments of Tower of Winds in Athens, and they likewise exist on the pediment of Temple Fortuna Virilis; they

a

are also found in Aphrodisias and in Patara. On a monument in the place last named, they are perpendicular to the slope of the pediment, but are otherwise absolutely vertical.

If with Vitruvius, one regards the dentils as roof strips changed into stone, they are to be placed above the mutules; "for no one places on Grecian buildings the strips beneath the rafters," -- and on the modillion cornice in the interior of Tower of Winds,[278] the dentils are actually executed above the modillions!

Note 278. Compare the preceding volume of this "Handbook." (2 nd edit. p. 218, Fig. 297).

Chapter 11. Corinthian and Composite Orders.

a. Corinthian Order.

308. Corinthian Order.

The beginnings of the Corinthian order in Greece promise greater things than it perfected later and in Roman hands. "A wealth of ideal life" is expressed in the capital, and what talent appertains to it, to make from the leaves of the acanthus (bear's foot) those that bend around the bell of the capital.[279] (Burckhardt. p. 10).

In all Roman architecture, especially in temple architecture, the Corinthian order is by far predominant. Rome yet possesses in the portico of the Pantheon the finest example, still beautiful in spite of the partial destruction and "pompous" restoration of the three columns of the Eastern side by Bernini; likewise good works in the remains of Temple Mars Ultor and Temple Vespasian. For Rome are also to be added the Temple Castor, that of Antonine and Faustina, as well as the Temple Neptune (pogana di' Terra), the latter being the smaller of these. Outside Rome are to be mentioned as being still well preserved examples, Temple Minerva at Assizi with its simple and tolerably pure forms, two columns of Temple Dioscurii in Cori, Temple Hercules in Brescia, the so-called Temple Vesta in Tivoli, the Maison Carree in Nimes, and the great multitude of splendid buildings in Syria.

309. Column.

"Except the capitals, the Corinthian columns have all proportions like those of the Ionic; the height of the capitals alone makes them relatively more tall and slender;" (Vitruvius, Book 4, 1); they likewise consist of base, shaft and capital.

310. Base.

The base is composed of the square plinth and the annular mouldings of the Attic base for columns. Instead of the simple scotia between two toruses, we also find this doubled here and separated from each other by two coupled astragals. The members are either left plain or are decorated by ornaments, such as bands, beaded and leaf astragals, pipes, and the acanthus.[280] The height of the base, including the plinth, equals or is generally rather higher than the lower radius of the column.(Fig. 424). On the buildings in Baalbec, there is al-

also frequently inserted beneath the plinth a plain square block, somewhat higher than it and but slightly projecting beyond it.

Note 280. Compare Canina. Sez. III. Plate 73.

311. Shaft.

The shaft is diminished at top by about 2/15 of the lower diameter (52 parts to 60 [281]), and it is executed with or without entasis (compare Pantheon); the height of the column, including base and capital, is to the lower diameter as:--

In Baalbec	1 to 9.00
Arch of Constantine	1 to 9.50
Temple Antonine and Faustina	1 to 9.50
Pantheon	1 to 9.5 & 9.7
Temple Vespasian	1 to 10.00

Note 281. The architectsof the Renaissance made the lower radius of the shaft of the column the unit or modulus and divided this again into 30 parts.

According to the nature and color of the materials and the more or less rich treatment of the building, the shafts are plain or fluted. For dark stone capable of being polished, they were undivided, or this was replaced by the brilliant line; for light or stone of uniform color, there were generally 24 flutes, that end in curved form at top and bottom or are even square.(Pompeii, Tivoli). The lower third of the flutes are again cabled, so that the shaft appears bolder below. A richer effect is likewise produced by carving small astragals on the fillets.(Fig. 425; Schola Xantha and interior of Pantheon), or by ogee forms of the flutes (Fig. 425 and the shafts of columns in S. Agnese at Rome). For the endings of these richer forms of flutings, leaf points are set between the semicircles, as shown by Fig. 425. Yet more richly treated is the ornamentation of the shaft, if the lowest portion of the shaft was concealed by tall vertical acanthus leaves, as in the example from Gerasa.(Fig. 425).

Spirally twisted shafts, ornamented by scales and leaves or mosaics (Pompeii), are not common exactly; but they occur.[282]

Note 282. Compare Canina. Plate 81.

Of the shafts of columns covered by scales or flat relief o or twisted, which exhibit a diameter of 0.53 to 1.31 ft. and

have heights up to 13.12 ft., beautiful examples are found in Museum Lateran at Rome, some of which are reproduced in Fig. 426, together with the mosaic surface of a shaft from Pompeii. In the Museum Louvre in Paris stand two shafts of columns, that exhibit the structure of the trunk of a tree, which pass for antique and apparently came from Etruria (Fig. 426). This form of shaft occurs on mediaeval buildings in Italy and with a quite naturalistic treatment during the high Renaissance in the columnar court by Bramante at S. Ambrogio in Milan. The priority of the idea likewise here recurs to the antique.

The shafts of Syrian buildings exhibit a peculiar addition in the consoles, which directly project from the external surface at about half the height of the shaft, and which were indeed intended to receive statues (votive objects ?). (Fig. 425; Palmyra and Kennawat).

312. Capital.

What Grecian art has to show in the form of capitals was also first repeated by the Romans. We find imitations borrowed from the Egyptian bell capitals, from the capitals of the Theatre of Dionysos and of the Tower of Winds in Athens, adorned by acanthus and sedge leaves,[288] as well as the perfected forms consisting of two rows of acanthus leaves and of scrolls -- but all is less refined or is enriched by accessories on the members, as shown by the otherwise beautiful bell capital of Kennawat.(Fig. 425). A fragment 1.41 ft. high in the Museum at Treves, composed of yellow sandstone, is in form almost identical with the Syrian example mentioned. Likewise the capitals of the Temple in Patara exhibit allied forms.

Note 288. Compare the preceding volume of this "Handbook." (2 nd edit. p. 285).

Vitruvius (Book 4, 1) gives for the elevation and the arrangement of the capital with the acanthus and the scrolls the "harmonizing proportions," which are illustrated in Fig. 427. If we compare the works with this scheme, it fits some very well; but the height is made too small.

If as Reber advises, we read in the text of Vitruvius "without abacus" instead of "with abacus", the rule then nearly agrees with almost all examples remaining in Rome.

The parts composing the capital are easily and clearly to be determined from the mutilated remains of Temple Faustina

at Rome, actually by means of its present condition; the curved abacus, the plain bell with the enclosing border and the astragal wrought on the shaft appear clearly, and the remains of leaves and stems show the manner in which they formerly enclosed the nucleus -- the bell --as a whole adorned and grew out of it.(Fig. 430).

The developed capital is shown by Fig. 428 in its perfected beauty, which is most richly executed in all its characteristic details, but which rather bears the character of a metallic than of a stone production.

More simply and yet more freely is the problem solved in Fig. 431, where merely a series of leaves surrounds the margin of the bell and the scrolls at the middle develop more richly into intertwined scrolls with rosettes.

On a capital from Aquileia on the contrary, smaller and larger leaves are arranged alternately; great star flowers ornament the centre beneath the abacus; then occur strongly scrolled volutes; the bell form remains indistinct, while the acanthus leaf shows only in the upper recurved portion a firm treatment of the leaf.(Fig. 429).

313. Pilaster, Anta and Pier.

What has been said of the columns is likewise true of the treatment of the pilaster, the pier and the anta.

The base is the same; the shaft is both plain or fluted, or it is paneled by small mouldings, the sunken surfaces being richly ornamented by vertical and scholl ornaments -- a mode of decoration, of which the most extensive use was made by the architects of the overrich works of the late period and again especially by those of Syria.(Compare Triumphal Arch in Orange, buildings in Baalbec, Palmyra, etc.).

One peculiarity is shown by the pilasters of the portico of the Pantheon, where the sharp edges at the corners give place to a small astragal with a peculiar treatment at the ends.(Fig. 425). Just as for the Ionic order, the circular capital of the column in all its details was transferred to the flat surface and no special form of capital was assumed for the pilaster, the pier or the anta.

The pilaster capitals of the early period do not exhibit the direct transfer of the perfected round capital to the flat surface

surface; they are plainly therefrom, as for example is the case on the Memorial Arch of Augustus at Aosta.(Fig. 432).

Similar forms are also found in Pompeii, though actually often only executed in painted stucco. There and on the Tomb of the Baker (Tomb of Eurysaces near Gate Maggiore and outside Rome, from the last period of the republic), as also in some Etruscan tomb chambers, we find the same peculiar pilaster capital (Fig. 433), which is affected by Grecian influence.

Permeated by the same Grecian spirit is the pilaster capital of the time of Hadrian, which again shows rather a metallic character and with it the sharply serrate acanthus leaf.(Fig. 434).

Peculiar is the nearly direct transition from the abacus to the nucleus form of the capital, which is only composed of a shallow cavetto adorned by small scrolls.

As peculiarities of the early and of the later period may be mentioned the treatment of the Corinthian capitals on the Memorial Arch at Aosta and the capital of the angle column on the Tomb of Diocletian at Spalato. At the former, the capital consists of two halves, both technically and esthetically; (Fig. 435). the lower comprises an acanthus bell with two successive rows of leaves, from which and strongly recurved, then spring the four great scrolls bearing the abacus and also the four small middle scrolls. On the same effect is based the capital of the Choragic Monument of Lysicrates at Athens. The construction of the capital is likewise found, but it chiefly occurred there for practical reasons, if its execution in one piece would have required too large a block of material, handled with difficulty. In the second case, it concerns a purely esthetic question of the form of the outline of the bell and of the abacus for capitals, that either had to receive a curved architrave or those meeting at an obtuse angle.

At the buildings of Villa Hadrian at Tivoli, at the baptismal chapel of Constantine in the Lateran at Rome, at S. Stefano itself, even at the Ionic circular Temple of Roma and Augustus on the Acropolis at Athens, 284 the normal capitals are shaped without regard to the form and position of the architrave; only in Spalato is attention paid thereto. The abacus

(Fig. 436) is there pentagonal, the edge of the bell being too sharply curved at the projecting angle. In spite of the wildness of the detail forms, the architect has yet sought and even found a peculiar solution, suited to the conditions of the problem.

Note 284. Compare Kawerau, G. Rundtemple der Roma und des Augustus. Antike Denkmaler etc. Vol. 1. 1888. Pls. 25, 26.

314. Entablature.

"The remaining members, which are placed above the columns, are either composed according to Doric proportions or after the Ionic style above Corinthian columns," says Vitruvius (4, 1). The Corinthian order, according to him, has no special rules for the cornice; one may therefore either make use of the triglyph frieze, with corbels on the main cornice and drops on the architrave, or choose the frieze ornamented by reliefs and dentils in the cornice. We find the use of both. Otherwise the combination of the triglyph frieze with Ionic columns (House of Faun and Temple of Apollo in Pompeii[285]) is nothing unusual. Corinthian columns with triglyphs are preserved on some tomb-shrines in Athens, likewise on the Arch of Augustus in Aosta and on the Temple of Augustus on the island of Philae; they also existed on the smallest and now destroyed composite temples in Paestum, on which dentils were even found over the triglyphs.

Note 285. See Overbeck. p. 851.

Note 286. Compare the preceding volume of this "Handbook." (Fig. on p. 245).

Beautiful examples of ornamental friezes with and without dentil cornices are given by the Temple of Antonine and Faustina and the Baths of Agrippa in Rome, where especially the frieze of old men and then the frieze of dolphins are to be emphasized as charming works.(Fig. 437).

315. Architrave.

As a rule, the architrave is divided into three bands; the bands are separated by astragals or fillets and ogees, and they are crowned at top by an ogee moulding between a fillet and an astragal. Mouldings and surfaces are either left smooth or are decorated by ornaments, as shown by the examples in Fig. 440, a, b, taken from the Pantheon and the Temple Di-

Dioscurii in Rome. The bands are mostly inclined backward. On the Temple in Atil -- no rule without exceptions -- there exists only a single band ornamented by a great fret pattern. (Fig. 440,c). And in Fig. 433, for example, instead of the architrave subdivided in bands, we saw one adorned by a figure frieze, as on the Temple in Assos,[287] representing the daily work of the deceased master baker Eurysaces at Rome. In a still more peculiar manner on the Theatre in Arles (Figs. 438, 439), the architrave is treated as a triglyph frieze, whose metopes are alternately filled with reclining oxen and rosettes -- a finely detailed work, really from the 1 st century A. D.

Note 287. See the preceding volume of this "Handbook." (2 nd edit. p. 110).

The thickness of the architrave corresponds to the upper diameter of the column, while its height amounts to 1.4 to 1.5 times the lower radius.(42 to 45 parts). The soffit is either furnished with simple recessed mouldings forming panels, or it has a decorated middle joint, or it is covered by richly ornamented mouldings and by scroll ornaments in relief. (Fig. 441).

Besides this is also found the continuous scroll frieze, as shown in its most beautiful treatment on the Theatre at Arles. (Figs. 438, 439). The Augustan period (Temple of Augustus in Pola, Maison Carree at Nimes) loved this ornamental motive, and particularly in Arles, it is believed that one must recognize in the cupind flying between the scrolls, the birds, animal figures, and heads in the receptacles of flowers, the delicately carved acanthus, the graceful stems with buds and bands, the models of the splendid arabesques of pilasters of the Italian Renaissance (Which are also so precious on the Ara Pacis Augustae).

A special treatment is exhibited by the architrave and the frieze of Temple Minerva in African Tebessa (See Chapter 18; Temple). Corresponding to each column and each pilaster are strongly projecting rectangular frames with ox-skulls in the panel, between which again extend sunken panels, enclosed and with interlaced ornaments. A moderately projecting moulding separates the architrave from the frieze, which exhibits an

allied ornamentation. The little pillars above the columns or pilasters are decorated by little figures in moderately great relief, and between these in long intermediate panels are arranged crossed cornucopias and suspended festoons. A bold and rich main cornice with consoles formerly crowned these overloaded and overrichly ornamented architectural members.

On the Triumphal Arches in Susa and Beneventum, on that of Titus at Rome, a series of little figures in relief (as on the Erectheum at Athens) form the ornament of the surfaces of the frieze.(See Chapter 2c, a; Monumental and Triumphal Arches).

316. Frieze.

The frieze is either of the same height, a little lower or a little higher (39 to 45 parts) than the architrave, plane (Pantheon) or convex (Temple Neptune; Dogana di terra), according to Grecian models, plain or as already shown, ornamented by sculptures.(Garlands of fruits in Tivoli, Baalbec and Suleim).

In a not exactly beautiful or justifiable manner, the architrave and frieze on the pediment facade of a temple are often combined into one plain surface and made a tablet for an inscription enclosed by a moulded frame.(Fig. 442). These works were mostly executed afterwards or were later additions, as may easily be recognized in Fig. 442, b (Temple Vesparian at Rome) and d. But the original execution appears in Fig. 442, a, c, as may be concluded from the abutting of the mouldings. Not unskilful is the solution on the so-called Arch of Goldsmiths at Rome (a), where the inscription tablet is enclosed between two figure reliefs.

317. Cornice.

The cornice is formed as a dentil or modillion cornice, measures in height 1 2/3 to 2 1/3 times the lower radius (51 to 59 parts) and in accordance with Vitruvius' rules, its projection equals its height. The modillions are shaped like the ends of beams (Palmyra), or they exhibit the form of beautifully curved volutes, whose undeside is covered by an acanthus leaf. They are also more frequently imitated from the stunted corbels occurring in the interior of Tower of Winds at Athens.(Orange in Fig. 443, c; Baalbec). At other places are found instead the entirely plain consoles of ogee form. (Fig. 443).

The front surface of the geison is plain or is richly ornamented by fret patterns cut in relief (Suleim, Baalbec), or by pipes, by strongly curved vertical water leaves (Temple Antonine and Faustina), the slab itself being lightened and enriched by coffers between the modillions, in which suspended rosettes complete the ornamentation.

The cyma is of ogee form and ends with a wide vertical fillet. Its front surface is covered by water leaves and acanthus leaves with lions' heads set at certain points.

Perfectly beautiful and likewise characteristic are the principal cornices of Temple Concordia at Rome, dating from 7 B.C., but splendidly restored by Tiberius (14 - 37 A. D.) and of Temple Vespasian, erected under Domitian (81-96 A.D.) and restored with excellent work under Septimus Severus, with its columns 49.86 ft. high. The different architectural members are too richly covered with ornamentation; the dentils on Temple Vespasian have in the interspaces the so-called blocks; the egg-and-dart moulding is edged with foliage; the surface from which spring the modillions is likewise covered by foliage, but the cyma has a row of leaves rising without spirit and of dry form. Balance and certainty in treatment are entirely lacking to this cornice in contrast to those of the time of Tiberius (Figs. 443, 444).

318. Pediment Cornices.

The pediment cornices repeat the forms and arrangement of the horizontal eave cornices, where modillions also extend along the pediments; the latter are eitner perpendicular to the slope of the pediment (Orange), only the modillion at the apex of the pediment being vertical, or in most cases they are quite vertical and have an oblique instead of a rectangular form. Just the most beautiful monument of this style -- the Pantheon (compare Art. 437 on this structure) -- exhibits this inconvenience.

319. Tympanum.

For magnificent buildings, the tympanum was indeed adorned by figures, tangible evidence of which is afforded by the beautiful relief of Temple Jupiter Capitoline, from the Arch of Marcus Aurelius and now in Palace Conservators at Rome.(Compare Fig. 113). The numerous holes in the high tympanum of

of the Pantheon permit the suggestion of arrangements for fastening bronze sculptured ornament, in relief on accout of the small recession of the tympanum behind the cornice.

Later art encroached on the tympanum by its excesses in form, when over the central and wider intercolumniation (Mousmieh, Spalato, Orange, representations of temples on coins of Hadrian and Gordian, Figs. 446, 447, a, b, c), it bent the entire cornice with its equipment of dentils and modillions into semicircular or segmental form, and thus destroyed the quiet and beautiful ending of the roof above the main cornice.

Whether for this innovation "more light" or caprice was the original impulse may be neglected here. Both are possible. It cannot be justified from the artistic point of view, the originally rich motive of the enclosed pediment has sunk to a dry enclosing frame. The similarity in form of the straight and arched cornice has an ugly effect; as well as the direct transition from the straight to the curved form on Palace Imperial in Spalato and on temples at Atil, Mousmieh, Damascus, and others.

A solution, such as that sought in the interior of the Baths of Diocletian or on the crypto-portico of Palace Diocletian, must be more satisfactory; likewise the entirely ornamental conception executed on the end of the Triumphal Arch in Orange has more in itself than the Syrian and Dalmatian examples. The setting of the inner columns in Spalato to form a smaller central passage must be termed less beautiful. (Fig. 446).[288] Also for the arches and niches of the City Gate in Nicea, and on the facade of a Tomb in Aizani, the innovation was firmly retained, to make the arches the expression of a curved architrave, whose horizontal ends rest on the capitals of pilasters. The passage taken from Vitruvius (Book 14, 1), that the Corinthian order has no special rules for the cornice, and that a triglyph frieze might as well be used as a cornice with modillions, is attested by a splendid example of the best period, the Memorial Arch of Augustus at Aosta. (See Fig. 435).

Note 288. Compare Texier, Ch. Description de l'Asie Mineure etc. Paris. 1839.

b. Composite Order.

b. Composite Order.

320. Composite Order.

It is a sport of the Corinthian order, and what was stated for that is generally true for the Coposite. The innovation in form consists of the capital; the remaining forms and proportions are the same; averaging 10 lower diameters for the height of the column, 2 1/3 to almost 2 1/2 diameters for the height of the capital (68 to 74 parts), 1 1/2 diameters for the height of the architrave and of the frieze (only on the Arch of Septimus Severus is the height of the frieze reduced to less than a module), 1 2/3 to 2 1/3 half diameters for the height and projection of the cornice.(51 to 68 parts).

321. Capital.

The capital consists of the Corinthian bell, which is crowned at top by an egg-and-dart moulding and a beaded astragal, and above the lower astragal it is enclosed by two rows of acanthus leaves. Flower stalks fill the vacant spaces on the right and left of the middle leaf of the upper row. Above the top of the bell lie four massive projecting volutes, connected together by a narrow band, like the Greco-italic capitals of Pompeii, and which are again covered by a normal Corinthian abacus. All members are ornamented, the channels of the volutes being filled by acanthus scrolls.(Fig. 448).

The capitals of the Arches of Titus and of Septimus Severus are to be designated as the best works with this order in Rome, to which might be added the Baths of Diocletian and of Caracalla. Those last mentioned are carved, chiefly for the strong effect, indeed on account of their elevated position in the interior of the building and in a dim light.

The geometrical representation of a composite column with cornice and impost of the vault is given by Fig. 449. It first occurs on the Arch of Titus in Rome, and according to Burckhardt, it is hard to conceive how men could sacrifice the upper part of the Corinthian capital, unless fashion were not stronger than anything else!

322. Fanciful Capital.

But men did not always employ this strong combination of Corinthian and Ionic elements; the restless, and to the observer, tiresome requirement of ever greater or increased orn-

ornamentation permitted the origination of a multitude of fanciful capitals, that have frequently remained to us only in fragments, but are also preserved uninjured on the smaller structures. Some of the colossal marble capitals in the Baths of Caracalla already exhibit at the centres of the sides of the abacus instead of the flowers, figures chiseled entirely free or standing behing the acanthus leaves, which in other examples give place to eagles or human heads. We likewise find griffins instead of volutes, arranged after the model of the capital of the Propylea in Eleusis,or winged horses and dolphins, whose intertwined tails support the angles of the abacus. Likewise flower stalks rise toward these angles and bear in their scrolls small coin-like medallion heads; birds with expanded wings sit on the acanthus leaves and pick the leaves of the stem of the central flower.

A wealth of beautiful and interesting examples of this kind are found in Museum Lateran at Rome.

323. Trophy Capital.

Rather like an experiment in Sculpture than an architectural work are the trophy capitals, which above a series of acan. thus leaves have weapons, armor and helmets, with winged victories supporting the corners of the abacus.(Fig. 450).

324. Pecuriarities.

We learned to recognize the shafts of columns of the different orders, according to the material employed, as having their surfaces smooth or covered by flutes; it was further stated for the Corinthian order, that besides the shafts that grow out of an acanthus bell, these may be found with the external surface decorated by scales and foliage or mosaic. The same was likewise the case for the rich Composite order. The Museum Louvre at Paris possesses antique shafts of columns, that appear like tree trunks with knots, and which also reappear in the Renaissance; for example, on the portico erected by Bramante, that opens into the court of the unfinished Church S. Ambrogio at Milan. Column shafts covered with knots and branches were also executed in the antique period. Twisted 290
shafts of columns were designated as very ancient by Belger, and which are likewise to be found in good Grecian art. In the preceding volume of this "Handbook" (2 nd edit. p. 87) I

have already referred to a fragment of a column with spiral flutes on the Acropolis of Athens; others are found on the Gate Borsari at Verona, etc.

Note 290. Jahrb. des Kais. Deutsch Arch. Inst. Vol. 10, 1895, p. 16. Sitzb. der Arch. Gesell. in Berlin.

For the base with spurs in Spalato (Fig. 451), Choisy had the kindness to state later, that it was very probable to him, that the base came from the same period as the granite shaft, which it supports. He believes the same in reference to the others; yet infallible evidence is lacking. It always seems singular, that it is found on but a single column, on the right hand of the arcade forming the background of the atrium. The architect of the K. K. Austrian Archaeological Institute, Mr. Wilberg, who was engaged in making drawings in Spalato, had the kindness to place at my command his measured sketch, that is reproduced in Fig. 452. While Choisy is unwilling to find any basis for a mediaeval restoration, Wilberg allows the possibility of such. The works on the exterior of the campanile, that occupied the entire open space with scaffolds and hoardings, made an examination impossible during a visit in the Easter week of 1901. Judging from the joints on the base (Fig. 452), the Roman origin of the spurs should only be accepted with reserve.

Note 291. According to two works by Choisy.

Note 292. From a friendly communication of Mr. Wilberg.

Benndorf furthermore finds such spurs on the base of a column on a sarcophagus in Aquileia.

Besides the free supports of octagonal section, there were also the capriciously built-in piers of half octagonal section on the external walls of the beautiful brick building, the Temple-Tomb of the so-called Deus Rediculus near Rome, whose plan and form of capital are shown by Fig. 453, a treatment not repeated elsewhere.

325. Technical.

Desgodetz[293] (p. 52) gives some technical details on Temple Concordia at Rome (now known as Temple Saturn), but which indeed belong to the time, when "the Senate and Roman people restored it after having been destroyed by fire," Desgodetz complains, that Palladio did not draw everything on it, which

is now to be seen, while Palladio intentionally omitted the awkward restorations. To these belong the two plinths beneath the bases of the angle columns, as well as the fact that only the monolithic granite columns are diminished, that one of the columns, wherein both investigators overlook that one of the columns was further inverted, indeed having the larger diameter at top. That likewise in setting them, lead plates were inserted between the bases and the capitals, the bearing surfaces of the ashlars were not rubbed, but were rather left rough and deeply pointed, that the cornice blocks were set on the architrave without mortar-- all this must indeed be placed to the account of hasty rebuilding at a later time. Concerning the stupidly arranged relieving arch in the tympanum, corresponding remarks have already been made.

326. Pier with Projecting Column and Panels.

To all orders belongs the pier connected with pilasters, half or three-quarter columns (Colosseum and Theatre Marcellus at Rome, Amphitheatres in Verona, Arles and Nimes), that receives both arches and architraves.

The enclosed and sunken surfaces of the shafts of pilasters and of piers belong to both the early (Augustan) period -- in the most beautiful manner on Ara Pacis Augustae -- and also to the late period, as presented by the buildings of Palmyra and the well known ruins of Forum Trajan.(6 th century A. D.). In both cases, the surfaces enclosed by the raised mouldings are covered by vertical, strongly conventionalized or even naturalistic leaves and flower ornaments.

327. Alternation of Materials and Ostentation.

The original stone materials -- the grayish-green peperine and the yellowish travertine --, from which were constructed the buildings of the republic and of the early imperial period, were abandoned, when after Augustus the far distant white marble became such a favorite, that in time men preferably made of it at least the columns and entablatures, wrile the walls were faced with slabs of this stone and with other costly materials.[294] The material ever compelled the architectural artists to a nobler treatment of form; yet variegated marbles, porphyry, serpentine, jasper, agate, and heavy gilding won supremacy, and this increased to a climax in the time of

Constantine. "Contractors and foremen become persons of more importance than designers," material and color win greater interest and spoil the form! Then is completed the change from the dignified to the impudent. the last trump of a phase of human powers at a certain time is played; the good is abandoned; but nothing better is introduced instead.

Note 294. Also compare Burckhardt. p. 10.

We will here recall the words of Hamlet:--[295] Act. 3, Sence 4.

"Could you on this fair mountain leave to feed,"

"And batten on this moor? Ha! Have you eyes?"

Chapter 12. Arches, Doorways, Windows and Niches; Caryatids, Atlantes, Small Members and Ornaments.

328. Arches and Archivolts.

In regard to form, as previously stated, the arch either has on its face the bold voussoirs with bosses, according to Etruscan models, or the same mouldings ornament it and follow the form of the arch, which are to be found on the door and window openings of the earliest period.

Since the arch may span an opening in the wall just as well as a straight lintel (architrave), then in view of the like function of both, the same ornamental treatment may be chosen for each one, and therefore the moulded arch should no longer be criticized as a curved architrave, or only so in case it exhibits horizontal parts above the springings, as in Nicea, Aizani, Spalato, Mousmieh, Damascus and Atal, which examples belong to the period of decadence.

The good period allows the moulding enclosing the arch to spring directly from the impost, in accordance with Etruscan and Grecian models (Aqueduct arches at Tower of Winds in Athens). The arch section divided in bands was given up in time, and a sunken band, harmonizing with the treatment of the pilasters, was employed as its profile, when the enclosed surface was effectively treated with scroll ornaments, leaf-rounds or garlands of fruits.(Figs. 454, 455; examples from Orange and Palmyra).

329. Imposts.

For the moulded arch, the lowest band is flush with the masonry lying above it -- and it thereby differs substantially from many Etruscan arches,-- all other mouldings therefore projecting from the face of the wall. The arch and pier are thus sharply separated from each other by a horizontal moulding (cap), and this is either more simply or more richly treated, corresponding to the orders or to the richness of the building (Fig. 456); for example, on the great gateway of the Arch of Constantine, a complete Corinthian cornice with modillions is repeated at a reduced scale as the cap at the springing.

On the magnitude of the projection of this cap depended also the projection of the adjacent pilasters or three-quarter

columns; in good works, the cap does not project beyond the surface of the pilaster or beyond the plane passing through the middle axis of the column and parallel to the face of the wall. Exceptions to this rule however sufficiently exist.

330. Keystone.

The ending of the arch is marked by a keystone of special form, which was ornamented after Etruscan models. It generally has a splendid volute modillion diminishing downwards and with foliage or figure ornament, which strongly projects beyond the arch section and emphasizes powerfully the crown, as is the case in a perfectly beautiful manner on the Arch of Titus in Rome.(Fig. 457).

331. Support of Arches.

If the column were designed to receive an arch, or better said, a vault as in baths and basilicas, then in the imperial period, the arch did not rise directly from the column, but from an entablature laid upon it, that was composed of architrave, friez and cornice. The period of decadence here created something new and even better, according to the opinion of many, when it reduced the height of the entablature and composed a new one of architrave and cornice alone, or this was entirely suppressed and the arch was permitted to spring directly from the capital.(Fig. 458). The sections of the archivolt, when wider than the radius of the column, intersect directly over the capital on the line of the axis of the column.

How the connection of the column and arch finally completed the change is shown by the series of steps in Fig. 459. The omission of the intermediate member between column and arch, which is strictly speaking an impoverishment in the domain of architecture, was also adopted by Byzantine art, where the antique feeling for the intermediate member was never entirely abandoned, and it sought this by inserting a stone block above the capital to receive the arch. A succeeding period followed the last in Spalato (Figs. 458, 459), which was also satisfied with the simplest type of stonecutting for the capital, in order to create a transition from the round shaft of the column to the square receiving the arch. Mediaeval art in Germany and France again referred to the antique models and

also placed on the antique flower or bell capital an enlarged abacus, which extended to almost the height of the impost block over the Byzantine capital, and it finally assumed a polygonal instead of a rectangular form, while the Renaissance again returned to the three possibilities of Spalato (Figs. 458, 459). Everything reappears in life and likewise in art.

The complete column set before a wall is before a pilaster, as a rule (there are also exceptions). The pilaster and column are then placed so far apart, that the capitals of both may freely develop or not touch at their greatest projection. (Fig. 460). Not in every case do the columns supporting arches extend directly to the ground, but like those projecting for ornament, they are frequently set on a block or pedestal, whose height for ornamental columns equals 1/3 to 1/6 of the height of the column.(Fig. 461).

332. Doorways.

Vitruvius (Book 4, 6) distinguishes between Doric, Ionic and Attèc doorways. For the former on temples, the uppermost line of the crowning cornice of the enclosure should extend to the edge of the capitals of the columns of the portico; the clear opening to be so arranged in height, that if the height of the temple from floor to ceiling slab be divided into 3 1/2 parts, 2 of these form the height of the door required, while 5.5/12 of the height is to be taken as its width. Doors up to 30 Roman feet (29.52 ft.) must be diminished in width, while those exceeding this height should have vertical jambs, moulded with the Lesbian cyma and beaded astragal. The ratio of the width of jamb to the clear width is not given by him; the lintel should have ears, and over it should rise a plain frieze with cap.

Ionic doorways are likewise to be diminished in clear width and are to be made exactly like the Doric' the width to be 2/5 of the height, while 1/14 is given as the width of jamb. The frieze is to be like the Doric, while the cap is to be supported by two stone consoles with fronts measuring 2/3 of the width of the jamb.

Attic doors are made like Doric; they only receive richer sections of jambs and lintel and are closed by doors swinging outwards and without grilles.

Among doors still remaining, we find those with vertical jambs and those with side casings reduced in width upwards, with or without ears on lintels, with plain frieze and cap, also doors with frieze ornamented by foliage, which is supported by great consoles at the sides and have caps decorated by smaller consoles or crowned by pediments.(Palmyra). Most of these doors belong to buildings of the Corinthian order.

Diminished and with ears is the door of the Temple in Cori, and diminished and without ears is that of the round Temple in Tivoli; the door of the Pantheon in Rome has vertical jambs, as well as the doors of the Temples in Baalbec and Palmyra. As the noblest example of an Attic door may be mentioned that of the Pantheon, 39.36 ft. in clear height (Fig. 376), as the richest Ionic, the nearly as large door from Baalbec (Fig. 464); the wide and richly ornamented jambs of the latter have 1/5 its clear width and produce an unusually dignified effect.

A similarly rich enclosure of a doorway with a cap on side consoles is given by Fig. 462. The ornamental detail of this work belonging to the time of Diocletian appears like careless and mechanics' work in comparison with that from the Augustan era. Merely compare the similarly arranged scroll work and animal forms with those executed on the Theatre at Arles. Here is the most refined invention, but there is the ancient desire; yet in spite of all routine workmanship, there is a certain rudeness in conception and execution. How tasteless are the vertical leaves of the cyma in comparison with the acanthus on the main cornice of the Roman Temple of Concordia, as well as the scalloped pattern, which should represent heart leaves.

333. Windows.

Like the doorways, the windows are sometimes exactly rectangular, sometimes of trapezoidal form; the enclosure is composed of the sill, the jambs and the lintel, which have the same section as for the doors. As an enrichment are added the cap or the angular pediment with or without palmatium angle and ridge acroterias.(Palmyra). The jambs, above which extends the lintel to form ears, either cut on plain belts, when the moulding stops directly on them (Tivoli, Palmyra), like the flutes of the columns on the stylobate, or the profiles of

the jambs are returned along the belt course and lintel, thereby forming an enclosure with ears both below and above the clear opening.(Fig. 463, both from the round Temple in Tivoli).

334. Niches.

Niches received a richer enclosure than windows, and which are arranged to animate the external wall surfaces in Baalbec, Palmyra, Gerasa, Mousmieh and other places. They are of rectangular or semicircular form in plan, when the openings are flanked by pilasters or columns extending to the impost or to the architrave. The arch of the niche then rests directly on their capitals, or the architrave forms a horizontal termination, above which only the frieze and cornice extend in curved shape to form the crown.(Fig. 464, b). Even the complete entablature may be carried around it as a crowning cornice, as in Fig. 465. The quarter-spherical vault is further ornamented by a delicately ribbed shell, which springs sometimes from the vertex, sometimes from the impost.(Figs. 464, 465).

The rectangular niches are mostly covered by a straight entablature (Fig. 464, a, c), above which rise either segmental or angular pediments, that are often returned in ugly form. Besides these likewise occur semicircular tympanums.

335. Caryatids and Atlantes.

Caryatids and atlantes were employed as supports, just as in Grecian art (Erectheum in Athens and Temple Zeus in Akragas), likewise in Roman, even if no tangible evidence thereof exists. We have the evidence of Pliny for caryatids, who states that such were made for the Pantheon by Diogenes of Athens; it was desired to recognize one of these caryatids in that placed in Museum Bracchic Nuovo and restored by Thorwaldsen.(Head and arms). For the well known improbable attempt of Adler to restore the interior of the Pantheon, which requires figures at least 12.46 ft. high, those of 7.38 ft. appear too small. They now perfectly accord with the Athenian model in pose and conception.[296]

Note 296. Compare the preceding volume of this "Handbook." (2 nd edit. p. 259).

We find atlantes executed at a small scale in terra cotta, which recall the colossal figures in Akragas in pose and the position of the arms,[297] in the tepidarium of a Bath at Pom-

Pompeii for supporting a cornice and between small rectangular niches in the walls.(compare the wall decoration of a Pompeian Bath on the adjoining colored Plate).

Note 297. See the same. p. 211.

336. Caryatids.

Fig. 466, b, c, d, gives a collection of antique caryatids substantially differing from each other. The stumpy form,of the Greek maiden (a) calms the observer; she is competent for the task,assigned to her; she can safely bear the burden; she is architecturally designed. It is otherwise with the others (b, c, d), of which that designated by d was never the support of an entablature. The head does not belong to the body; the chin, nose, a part of the basket, the right arm, the toes, a part of the garment, the skin and the girdle are restored. 298 The two marked b and c are proud and stately female figures, entirely concealed in clothing, only the hands being left free. They support high baskets on their heads, ornamented by palm-leaves, instead of the compressed Grecian cushion, that lies flexibly on the head and renders probable the reception of a burden, or indeed makes this a certainty. The tall basket, the complete clothing of the body permit doubts to arise, whether they were not otherwise utilized formerly. Most readily is the caryatid in Fig. 466 c admissible as the support of an entablature, being the only one of the three that exhibits a firm architectural pose.

Note 298. compare Bulle, H. Mitt. d. Kais. Deutsch Arch. Inst. Röm. Abt. 1894. p. 135 et seq.

337. Small Members.

The small details are on the whole imitated from the Grecian, and they have suffered various changes in the different periods, according to the feeling of the architect for form or by reason of external influences.

Already in their succession in the forms of cornices, etc., there are produced numerous incongruities in comparison with the logical Grecian design; in detail are the different forms less animated and elastic; for the cymas were employed instead of free hand curves, rather those struck with the compasses, and the forms are furthermore frequently composed of the latter; the extravagant and wearisome love of ornamenta-

ornamentation also frequently covered everything with leaves and flowers, without previous consideration of sense and possibilities. But it is not excluded, that in all periods of Roman art beside the good is found the bad; or sometimes the converse, that an architect of refined feeling in the period of decadence rises above the debased form expression of his time and returns to Grecian methods. For example, a proof of this is found in the detail of the Baths of Diocletian (305 A. D.), which exhibits at the angles of the egg-and-dart and heart-leaf mouldings of an Ionic entablature the same solutions as on the Erectheum, [299] and it declines the usual and more convenient overlaying of an acanthus leaf,-- of the fig leaf, with Roman art so loved to cover its bare spots.

Note 299. Compare the preceding volume of this "Handbook". (2 nd edit. p. 257).

338. Egg-and-dart and Heart-leaf Mouldings.

As for the egg-and-dart and heart-leaf mouldings of Grecian art represented in the preceding volume of this "Handbook" (2 nd edit. p. 257), what they became in time is shown by the necessary examples in Figs. 467, 468. The form at first remained to the heart-leaf, even if no longer in its delicately designed outline, the downwards extending midrib of the lanceolate leaf only having to give place to an ascending flower bud; the wavy outline of the leaf was afterwards changed into a notched trefoil one, and these alone were retained, while the surfaces between and on the former surfaces of the leaves were covered by buds and flowers directed upwards and downwards. The special solution at the angle is commonly omitted, the junction at a corner is covered by an acanthus leaf extending in both directions.(Fig. 469).

The egg-and-dart moulding was somewhat flatter in the Hellenistic period, and it looks rather like an opened mother-of-pearl shell than a leaf, and in this form it was employed with special preference in the cities south of Rome. For the great buildings in Rome, this detail must have been more effectively wrought, we therefore find there the great incisions and undercuttings for producing the most animated effect of light and shade possible.

The remain only the ends and the midrib of the pointed leaves

and the former are like arrou heads set between the ovate leaves. As the extreme effort in the mania for ornamentation is to be regarded the covering of the edge by the acanthus and the decoration of the egg form by flowers, when the pointed leaves are changed into broad water-leaves (Fig. 467). For the solution at the angle at both convex and reentrant corners, the statement relating to the heart-leaf is true here.

339. Beaded Astragal etc.

Beaded astragals follow the Grecian models with few modifications, as well as interlaced bands, fret patterns and rosettes. The latter frequently receive a more animated form, for they escape from the rigid Egyptian-Grecian restraint; astragals with the typical beaded ornamentation were also treated as twisted ropes.

340. Dentils.

Among the visibly effective members, the dentils, the surfaces of the intervals are less effective, being sometimes but slightly recessed behind the faces of the apparently supporting parts, sometimes cut obliquely; they are also frequently executed after the Grecian manner. The extravagant love of ornamentation also frequently here places a superfluous, mean. ingless and puerile ornament in the intervals, as shown by the dentils on the Temple Vespasian in Fig. 469. These are the so-called "curls" (lockchen) between the dentils, which became typical from Domitian onward.(81 - 96 A. D). The angle is soon furnished with a supporting block, or better one is suspended free in an entirely non-asiatic way (Fig. 469; Temple Fortuna Virilis), or it is left vacant after Grecian methods. While Grecian art was satisfied in decorating the underside of the covering slab at the angle by a slight palmatium, the Roman places here a suspended ornament, the pineapple.

At reentrant angles two supporting blocks intersect and combine into a polygonal whole; if the dentils extend along the pediment, the entire block is usually placed at the apex.(Fig. 469).

341. Volute Consoles.

The volute modillions of the cornice are mostly conceived as ornamental, since they form sculptured ornamentation rather

than functional members, on the form of which everything necessary has been said in connection with the Corinthian main cornice, their positions at the angles are usually and in the bestperiod always the same as for the dentils in the good period. We find diagonal modillions first in the period of decadence and but rarely then.(Palmyra).

342. Ceiling slabs.

The front surfaces of the cornice slab are otherwise without ornamentation, but in overrich works they are decorated by pipes or by fret patterns. For dentil cornices, they are either furnished with a flat water-drip, or for modillion cornices, they have sunken panels adorned by rosettes.(See the Corinthian main cornice).

343. Acanthus.

The plant chiefly employed for architectural ornamentation is the acanthus, which is used in all dimensions, and whose form shows the greatest diversity, according to the material employed and the individuality of the artist. It sometimes follows the Grecian model with the sharply toothed leaves and the broad pipes and ribs (Fig. 470; Temple Vespasian, Temple at Cori), or the leaves retain the outline and the subdivision -- which we may designate as the ordinary Roman, since it more commonly occurs and is an innovation from the typical Grecian -- or they rather assume the form of the native olive or evergreen oak leaves. Ribs and pipes then become finer and on the recessed portion are often furnished with small serrate leaves (Fig. 470; Temple Mars Ultor, Temple Dioscurii and details from Museum Lateran at Rome). On parts sculptured for strong effect, the parts of the leaves are separated from each other by deep incisions, as shown by a Composite capital exhibited in Museum Lateran.

A peculiar character is assumed by the acanthus in some provincial cities (Pompeii, Tivoli, etc.), when the points of the leaves are recurved on the surface of the leaves and thus the leaf itself has a puckered appearance like a cabbage leaf, neither quite beautiful nor clear.(Fig. 470; Pompeii). The Syrian architects remain on the Grecian basis in the form treatment of the acanthus; they only fall usually into a pattern and listless manner. The leaves remain sharply serrate;

the surfaces have good alternation of light and shade, but are too deeply cleft, and the otherwise animated and nobly swelling parts of the leaves lose themselves in nearly horizontal lobes of weak character.(Fig. 470; Gerasa, Bosrah).

Acanthus and scroll ornaments certainly reached their most beautiful climax in the Augustan period, as indeed was proved on the famous Ara Pacis Augustae at Rome.(Figs. 471 to 473).

The treatment of the acanthus leaf executed in white marble is metallic and sharp, but again is still beautiful in details; the leaves are effectively subdivided by strongly projecting midribs and pipes with recurvatures, and from them is developed the scroll-work in such flowing and beautiful form, that its expanded rosettes, its closed and opening buds, leaf overlays and delicate shoots are so harmoniously and uniformly distributed over the surfaces, that a more perfect arrangement could not occur--, like the most beautiful tapestry ever conceived by ornamental sculpture in an ideal and fully stylistic manner. Grecian talent and Grecian hands may have aided here, but they have matured somewhat, which could only occur on Roman soil and under changed external conditions.

Grecian origin is also recalled by a frieze, that was found on the Forum Roman (perhaps belonging to the Regia) with winged geniuses and scroll-work most delicately executed.(Fig. 474). I also add the work from the Theatre in Arles (Figs. 438, 439); these and those mentioned from the Ara Pacis and the Regia indeed afford the best illustration of the ornamentation employed in the Augustan period, just as the precious relief frieze of the Ara Pacis is the finest manifestation of that time in the domain of portrait sculpture with entire figures, and which will remain for all time refined and representative, -- a jewel of higher, nobler and ideal art!

But besides the ideal-conventional tendency there also becomes apparent in the Augustan period a naturalistic one, since Fig. 475 also belongs here, and the stucco reliefs in the temple-tombs near Rome and in Museum Nazionale show these, which are executed with equal skill and with good observation of nature, without employing "plaster casts from natural forms" or still less Japanese sketch books as with us today.

More calculated for effect of light and shade, but still be-

clearly and beautifully designed and with its masses well subdivided in the frieze, where the plant forms are copied directly from nature and are mingled with conventionalized animal forms, plants and fruits, which must belong to the time soon after Augustus.(Fig. 476). Animated in movement and less plain in form, betraying the sway of the tooth chisel, which plays a great part in the Renaissance and again in sculptures today, and which together with the drill has produced so much that is bad in sculpture, is the scroll and acanthus work on the frieze found on the Forum of Trajan.(Fig. 479). The egg-and-dart moulding sculptured for effect, the debased heart-leaf moulding, only marked by incisions, permits the conjecture of its origin at the beginning of the 3 rd century A. D. or in the time preceding Diocletian.

Bombastic is the scroll work in Fig. 478, which in many respects recalls that of the time of Septimus Severus (193 A. D.) on the so-called Arch of the Goldsmiths -- the memorial Arch of the Money-changers (Arcus argentariorum), -- but still more the scroll work on the so-called Frontispiece of Nero in Colonna Gardens on the Quirinal at Rome,[300] and which should indeed be placed in the time of the end of the 2 nd or beginning of the 3 rd century. The elegantly flowing forms of the Augustan period have vanished and have given place to nothing better, but indeed to those far inferior. As the perfected Corinthian capital was succeeded by the Composite, so here twisted and stumpy forms supplanted the refined ones -- but there is ever less art and knowledge in these works, -- it was the fashion, of which it is said, that it was stronger than beauty and reason.

Note 300. Compare Desgodetz'work. p. 66.

One would believe it a mediaeval production, when he sees the naturalistic scroll work of a pilaster panel in Fig. 477, that was likewise found on the Forum of Trajan and is now preserved in Museum Lateran. It recalls the ornamentation of the ruins of Maschita, East of the Red Sea, whose date is not yet determined. The ornament[301] on the base, consisting of a continuous series of triangular panels, shows the latter entirely covered by vine leaves and small animal forms. It is said to be Byzantine and has the strongest artistic and practical rela-

Relationship with the pilaster frieze of Forum of Trajan. If we term the Eastern-Roman art of the 6 th or 7 th century Byzantine, then may the classification and date perhaps accord.

Note 301. A view of this in Geschichte der Baukunst. Die Baukunst des Altertums und des Islam in Mittelalter. By R. Boormann. p. 315, Fig. 249. Leipzig. 1904.

The Roman ornamentation in the tributary provinces toward the northwest beyond the alps and to the southeast in the Dobrudja was frequently in the hands of artizans, who actually served in the legions, and that indeed in time settled permanently in the foreign provinces. The great tendency always continued in Rome alone. Compare in this sense only the specimens in the Museums at Treves and Mentz -- and those are the best -- with what the mother country matured. What has awkwardness and lack of artistic ability made of the grandly composed monument at Adamklissi, for example! How Grecian detail (Fig. 481) has been mistreated in the provincial ornaments of Badenweiler![302]

Note 302. On the columnar orders and their details, compare Part 1, volume 2 of this "Handbook".(Die Bauformenlehre. By J. Bühlmann). -- Further, Bühlmann, J. Die Architektur des Klassischen Altertums und der Renaissance. 2 nd Edition. Stuttgart. 1902.

344. Other Plants.

There was otherwise employed in ornamentation nearly the the entire plant world with its leaves, flowers and fruits, sometimes strongly conventionalized, sometimes entirely naturalistic. Laurel leaves, oak leaves and acorns are found on the rounds of friezes and bases, systematically arranged and held together by interlaced bands. the honeysuckle in the palmatiums, developed in severely architectural form; naturalistic vine leaves with grape clusters on ash urns; white thorn leaves, poppies, lilies and roses in garlands; buds and unfolded flowers, convolvulus, pumpkin flowers and leaves, water leaves, ears of grain, figs, fruitu of all kinds on the sections of the frieze and the archivolts of triumphal arches; birds, little quadrupeds and insects animate the foliage and scrolls in panels and friezes, which spring from an acanthus leaf, from human or animal forms. The combination of strongly

conventionalized and naturalistic ornaments appears so effectively and so gracefully in certain decorative works of Roman art.

Most freely and beautifully was developed the acanthus and the entire series of native plants and flowers on the splendid candelabras, urns, panels, and the works of the minor arts, of which Museum Lateran shows the richest material in purely architectural objects, the Vatican and Neopolitan having such in the minor arts -- inexhaustible mines for the studious architect. Roman ornamentation celebrated the greatest triumph in acanthus and scroll work, which decorates the front of the Vatican chariot, the naturalistic forms enclosed by garlands of roses, and on the candelabra of Museum Lateran, executed in relief.(Figs. 482, 483).

345. Final considerations.

A good part of Roman ornamentation is under the ban of Grecian art; much of it may have been formed after unknown models of the time of the Diadochides: but much truly beautiful was certainly created by Roman genius, which may claim individuality.

Burckhardt comes to this conclusion in his studies of the era of Constantine the Great [303] (p. 209); "Painting can exhibit an inner law or at least an experience, whereby periods of idealistic modes of representation are followed by naturalistic, either because the former have not entirely fathomed the forms of nature, but has pleased itself with general forms, or because the series of its necessary creations has been completed, and since man hopes to find new means of effect in dry naturalism."

What is true for painting may likewise be assumed for sculpture and its accompanying art of ornamentation. "Already after the best period was a multitude of genre statues and pictures; entire schools were characterized by a closer adherence to reality." (Compare Fig. 480, a, b; also the Vatican collections of genre objects.). In the 1 st century A. D. occur naturalistic foliage and flowers in ornamentation, but in the right places and on certain objects or portions of buildings. These again recur and indeed are never suppressed in later centuries until the fall of the empire.

D. THE MONUMENTS.

Chapter 13. City Lay-outs (camps) and Plans; City Walls, Gates and Aqueduct Gates; Street Pavements, Milestones and Military Roads; Street Traffic and Lighting; Representations of Cities.

346. City Lay-out.

The plan of Rome on its seven hills is just as little regular as that of the previously mentioned larger Etruscan cities.[304] Even the provincial city of Pompeii cannot show a regular course of the enclosing walls, although these are the broad Cardo and Decuman streets (major and minor), that intersect at apparently a right angle. Blocks of rectangular form, intersected by narrower streets, are arranged on the right and left of the principal streets; but curved streets and one blind alley with irregular blocks of houses are to be mentioned.

Note 304. Compare Lanciani, R. Ruins and Excavations of Ancient Rome. Fig. 150. Boston & New York. 1897. -- Then, Hülsen, Ch. & H. Kiepert. Formae Urbis Romae. Berlin. 1896. -- Also, Schneider, A. Das Alte Rom. Leipzig. 1896. (The last mentioned publication with very instructive plates relating to the increasing extent of the city).

To ancient Rome (Roma Servii Regis) had already been added and built over in the time of Servius Tullius, the Quirinal, the Capital, the Palatine, the Aventine, the Caelian, the Esquiline and the Viminal, and the interiors of those quarters were made accessible by 13 or 14 gates in the city walls. The principal arteries of communication in the city all ran toward the centre of public assemblage -- the Forum -- at the foot of the Capitoline and Palatine hills, to the place at which emperor, senate and people had arranged places for their councils, at which the weal or wo of the state was considered. Via Flaminia, Via Appia, Via Tiburtina and Via Labicana among others take this as their starting point toward all directions of the compass; here likewise stood the golden milestone, from which were reckoned the distances to the different places in the provinces.

347. Permanent Camps.

It was otherwise with the cities that originated from permanent camps (castra), and which became the origins of cities of

more or less importance, especially in the provinces.(Gaul, Britain and the Danubian provinces). Plans of such permanent camps have resulted in great numbers from investigations, of fortresses, and we can refer to these, especially to the now most fully discussed Castle Saalburg near Hamburg-on-H, of which the ground plan is given in Fig. 485.[305]

Note 305. From Jacobi, L. Das Römercastell Saalburg. Hamburg. 1897.

The basal form is a rectangle, surrounded by a doubled trench, over which 4 bridges lead to the 4 gates -- Porta Praetoria, Porta Decumana, Porta Sinistra and Porta Dextra. Behind the trench rose the gateways protected by 2 square towers and the walls crowned by battlements, with inclined banks for the defenders to stand upon in the interior. The headquarters buildings, barracks, storehouses, etc., stood within the stone walls.

In the permanent Camp at Neuss, which was of greater extent, besides the praetorium was discovered a larger principal building, the quaestorium, and also 4 barracks. The ground plan otherwise corresponds in general and detail to that of Saalburg,[306] so far as relates to the course of the definsive walls.

Note 306. See Clemen, P. Kunstdenkmale der Rheinprovinz. Plate 8, pp. 53 et seq. Düsseldorf. 1895.

On the Austrian frontier is prominent the great permanent Camp in Carnuntum,[307] which is fully treated in the publication on the frontier.

Note 307. Der Römische Limes in Oesterreich. Heft 4. Pl. 2. Vienna. 1903.

The ancient Augustan walls of the permanent Camp of Aosta (Fig. 486) still form the walls of the city of the same name, enclosing a rectangle 1876 × 2375 ft., fortified by 14 square towers and walls crowned by battlements. The massive gates Praetoria and Decumana are still in their ancient places and are in use; inside are the ruins of an Amphitheatre, a Theatre, and the subterranean cisterns or storehouses afford eloquent evidence of the life and energy of the inhabitants. Out of the ancient camp under assured political conditions grew a city with a garrison of 3000 men, after the slaughter

of the Celtic Salassi.

The ruins of a permanent camp and of a city springing therefrom, is given by the plan of Troesmis in the Dobrudja in Fig. 487. The plan is likewise a rectangle enclosed by walls but is here defended by round towers, and which contains inside it the public buildings and houses of the ancient city.

848. Representation of City Plans.

Rome had indeed arranged its particular ground plan in a most monumental manner, worthy of the mistress of the world, and excelling the other cities of antiquity. On a large area of white marble slabs was engraved the plans of the buildings with corresponding inscriptions, and this was combined into a whole and made accessible to the people. "Behind the Church Ss. Cosmo e Damiano were found the remains of the ancient plan of the city. The ancient walls, to thich the plan was attached, belonged to a subordinate structure of the Forum of Peace, which is held to have been an Archives for census officials, erected by Vespasian and restored by Septimus Severus, (for the preservation of the Survey Map of the city), and it is usually termed Templum Sacrae Urbis." Not far from an end wall of the Basilica of Maxentius with its apse still stands the wall with the vestiges of the fastenings of the slabs forming the plan. The remains of the latter were collected, and in the garden court of the Capitoline collection, were set in a white background of stucco, as far as they were related, the course of the Tiber being painted thereon in blue. The remains of the plan are joined in the proper quarter of the city, so that orientation is easily possible. This restoration of the city plan was an act, which aroused merited attention at the Archaeological Congress in Easter of 1903 in Rome, and it met with universal concurrence. The remains of the marble plan of the city prepared under Septimus Severus (205 A. D.) -- the "Formae Urbis" --, which in great part was rediscovered in the 16 th century, and it is that so arranged on the northwest wall of the same court by Hülsen and Lanciani, and it was set as far as possible as it was placed in antiquity on the so-called Templum Sacrae Urbis. The plan is executed at the scale of 1 to 250. The orientation is assumed as South, as usual for antique plans. An illustration of the rectangu-

rectangulas slab with the inserted remains is given by Fig. 488.[308]

Note 308. Compare Hülsen, Ch. Porticus Divorum und Serapeum im Marsfeld. Mitt. der Kais. Deutsch Arch. Inst. Röm. Abt. Vol. 18. p. 23. Rome. 1903.

349. City Walls.

The city walls intended for defense were at certain distances strengthened by piers, square and semicircular towers, and furnished with battlements; the towers with the adjacent walls were built particularly strong and their defensive resistance was heightened by flanking towers. Sandstone, tufa and limestone, as well as burned bricks, served as the material for this construction.

The form and construction of the city walls changed in time, according to the state of the science of war and of experiences in carrying on sieges. Thus the Servian Wall at Rome, designated by Cicero as the most massive of walls, consisted of a circuit of walls enclosing a city of a million people, with separate fortifications within it. At points where the border of the city was not already formed by steep rocky precipices, the ditch of 98.4 ft. width and the wall 82. ft. thick extended as a fortification.(Compare Fig. 33). With a system of square defensive towers set very near each other, which in the lower story were strengthened by a thick addition on the outer side (Fig. 489), the last phase of Roman fortification of cities ended in Rome under Aurelian and Probus.(271 - 276 A.D.). The walls were 55.76 ft. high and 9.321 miles long, and 13 gateways were built in them, requiring about 364,649,000 cubic feet of brickwork and an expenditure of $5,200,000.

On the inner side, the wall was strengthened by massive porticos (Fig. 490), which were indeed intended to receive the troops and materials for defense. Stairways in the square towers led to the passage for defense and to the platform of the tower. An extent of about 229.6 ft. between Gate S. Giovanni and Gate S. Croce in Gerusalemme is still preserved by these porticos.

Besides the square towers, which projected from the walls externally, semicircular ones were also placed on both sides of the gates, and whose former existence is assured at Gates

S. Sebastiano and S. Paolo, Arenaria, Nomentana, Pinciana and Latrina. Octagonal flanking towers are shown and still exist at the gates in Spalato and Salona, 16-sided towers of 26.25 ft. diameter were at Gate Palatina, called Palazzo delle Torri.

A freehand drawing in the Kaiser Deutsch Archaeological Institute at Rome (Fig. 491[309]) shows a crenelated wall with a gate and towers, which have projecting angular buttresses below and cut-off angles above.[310]

Note 309. From a Drawing in the K. D. A. Institute in Rome.

Note 310. The original drawing bears the title; Descrizione del Castro Pretorio e degli Avanzi antichi essisstente nella Villa Torlonia presso la Porta Nomentana. (Library of K. D. A. Institute at Rome. K. 157. Without text).

Broad rectangular towers with round-arched windows in two stories are possessed by the walls of Aosta.(compare Tower Pailleron; Fig. 492). They are built of plain ashlars in courses and exhibit no architectural ornamentation of any kind. The "Pailleron" Tower met its fate in time; the walls were broken through for the entrance of a railway into the city and the tower was spoiled by additions. A later period also has its rights and not everything ancient can be retained -- but men should preserve some memorials. This is said for an understanding of Fig. 492.

In view of the procedures in Heidelberg and Freiburg-i-B, men would have all new stones prepared with the same chisel strokes, so far as these are recognizable, and coursed in the same manner, perhaps even covered by a patina, so that a counterfeit antiquity cannot be recognized as such. In Aosta as well as at this time in Rome (Forum Romanum), men proceed otherwise and indeed more correctly. They wish to restore the original form, but to make the restoration so visible, that later investigators in judging of ancient architecture may not have the same results as others with skilfully repainted old pictures. This method is likewise more correct for science and art than the favorite one, without most deceptive dressing up of ancient works, which even causes most persons to shake their heads.

350. Wall Caps; Battlements.

The Gallo-Roman city walls, like the Grecian and Etruscan,

had a parapet wall about 3.28 ft. high and battlements 6.56 ft. high; the latter were so arranged, that a man found protection behind them while aiming or shooting. Breast wall and battlements were covered by slabs projecting all around, as shown by Fig. 493.

Promis[311] (see his work) gives the same battlements for the walls in Aosta, but of which nothing more was to be seen at my visit in the year 1902. Even Stubbe[312] must have seen no more, according to the report of his tour.

Note 312. See Centralblatt der Bauwesen. 1897. p. 117, 132, 153.

The parapet wall in Aosta is separated from the vertical masonry by a projecting rectangular band, but this is not extended around at the same height, rather following the form of the balustrade and offsets therefore became necessary, which still exist. The battlements on the walls of Pompeii are more Greek than Roman, and they have a transverse projection at each battlement; both form small cells from which each defender could look down upon and aim at those standing outside. (Fig. 494[313]). The construction with the wall, ditch and tower is shown by Fig. 495. The wall mass is 26.25 to 27.89 ft. high and fully 19.69 ft. thick,aand it consists of two faces 2.30 ft. thick each, the spaces between them being filled with earth. Both walls were strengthened by buttresses; the internal wall also had them projecting into the intermediate space, to present a better resistance to the masses of earth' they rose externally 9.84 ft. above the passage for defense, so as to catch shots directed into the city. Noteworthy on the parapet are the stone water spouts, through which rain water was conducted outside the wall. Before the inner wall was thrown up a bank of earth, over which stone steps led to the level of the defensive passage. Behind the high inner wall troops placed there also found protection. The rectangular towers measured 31.17 × 24.94 ft. in plan and contained two strongly vaulted rooms above each other, which were connected by stairways and led to the platform on top.[314]

Note 313. Reproduced from Viollet-le-Duc, E. Dictionnaire Raisonnee de l'Architecture Francaise. Vol. 4. p. 375. Paris.

Note 314. Also compare Mau. p. 221.

Battlements showing an arched form and also wrought as reentrant blocks were found in Wimpfen, Treves and Regensburg. But one need not always assume battlements with cross projections for the reentrant blocks; they might also have served as peaceful coverings of walls for enclosures, fences and the like, as B. Hettener, for example, rightly states.(Figs. 496, 497[315]).

Note 315. Compare the Illustrated Catalogue of Museum Provincial in Treves. p. 57. 1903.

By the Romans of the imperial period were no longer employed battlements with cross pieces; they continued to use the simple crenellated wall, which was retained for defensive purposes until the 11 th century and only experienced changes by the Byzantines and Arabs, on account of their new war machines.

Towers might also belong to open cities, and they then subtantially differed in design from the towers of fortified cities. The former were vaulted passages for chariots and foot passengers, the others had an arrangement already common to the Etruscans. They consisted of an outer gateway, which could be closed by a portcullis, and an inner one closed by wooden gate leaves covered with iron, and of a kind of uncovered court, into which opened both gateways. The Gate Herculaneum in Pompeii (Fig. 498), the Gate Pretoria at Aosta(Fig. 499) yet exhibit this arrangement and its connection with the city wall. The Gate Porta Nigra at Treves (Fig. 500) has the same arrangement, but its junction with the city wall can no longer be recognized, while the Roman North Gate in Cologne again exhibits the court with the adjacent wall.(Fig. 501[316]). The same is true of the palace gateways, the Gates Ferrea, Aenea and Aurea at Spalato, and many other places. Other gates had only a larger vaulted passage, while yet others show two entrances, like the Gate dei Borsari in Verona, the Gate Nigra in Treves, the Gate Sea in Pompeii, or three like Gate Herculaneum at Pompeii or Gate Praetoria at Aosta, or even four like the city gates in Nimes and Autun.(Figs. 502, 503). For the double designs, the openings might be of equal size and intended for chariots and for persons on foot, or for those entering and those departing, or they were dissimilar and as at Gate Sea in Pompeii, one served for foot passengers, the

the other for chariots. For gates with three or four openings, the two middle ones were intended for chariots and horses, the two smaller ones at the sides being for persons on foot. (Fig. 502; Gate Augustus in Nimes). We frequently find galleries and upper stories built above the gateways and enclosed between flanking towers.

Note 316. Also see Centralblatt der Bauwesen. 1893. p. 81, 127, 274.

A yet easily recognizable relationship is shown by the plans of the Gates of Treves and of Aosta with the uncovered court flanked by towers. They are likewise not so very different in the ground area covered. (Compare the ground plans in Figs. 499, 500). In both is possible the shooting from four sides upon an entering hostile party; both exhibit the arrangements for the portcullis in good preservation. The recesses for the portcullis at Treves have for a height of about 18.05 ft. a width of nearly 2 Roman feet, and of 0.85 ft. in Aosta, those of Gate Caesarea at Salona being 1.12 ft., and of 0.52 ft. at the Gate of the Palace at Spalato.(Porta Aurea). How the portcullis moved in the recesses is easily seen in Fig. 504. From the lowest defensive passage, which extended almost as high as the gateway beneath it, the portcullis in Treves was raised and dropped, where the men operating it were protected from missiles, while the assailants could be repulsed from the windows of the defensive passage above it. (Fig. 504). Interesting is the arrangement (in Spalato, Fig. 505) of the grooves for the constructed round and straight arches. The technical execution of both gateways (Aosta and Treves) is equally careful, in spite of the centuries lying between them.

The foundation of Gate Nigra in Treves are built of irregular broken stones with lime mortar, while the stones of the superstructure are joined by iron cramps and are so finely jointed without mortar, as to be scarcely visible in completely wrought places. The material is gray sandstone from the neighboring forest of Pfalzel. Schmidt[317] (see his work) is of the opinion, that the stones were not only dressed before setting and that they later only received the intended mouldings, which corresponds to ancient practice, with which I must fully agree.

Attention has already been called to the stonecutters' marks; von Domaszewski [318] points out a particular group of them, the daily dates, which are found in the third story of the western tower. They were inscribed after the setting of the blocks, and from their increase in the direction of the rising building, its progress may be determined. Von Domaszewski finds in them the proof, "that men built in great haste," evident vestiges of which are also shown by the building. "Not alone, that nowhere were pains taken to dress the ashlars smooth, so that the quarry marks remain everywhere-- on which 170 of these marks have remained legible -- ; even the architectural details of the building were only cut after the rough blocks had been inserted in the wall."----Hence comes also the picturesque, though not intended effect of these rusticated walls, which permit the gateway to appear as if hewn in the rock. This mode of construction shows absolutely, that the fortifications originated in a time of great distress and thus justify the fine investigation of the walls of Treves by Lehner. As Lehner saw, this is certainly a work of the emperor Gallienus (260 A. D.). Like the fortifications of that period, the city gate of Treves was likewise built by the hands of soldiers.

Note 318. See Correspondenzblatt der Westdeutschen Zeitschrift für Geschichte und Kunst. Jahrg. 22. No. 10. (Oct. 1903) Miscellanea 82.

But von Domaszewski now continues further:-- The model for the arrangement of the plan at Treves is to be sought in the far East, at the Gate Decumana of Castle Odruh in Arabia; (Trajan's frontier castle; Fig. 506); but there the gateway and the city wall lie in the same plane, the towers projecting far beyond them (like those of the Castle at Troesmis), while at Treves they project but slightly beyond the plane of the gateway and thus weaken an effective defense of the gateway and walls. As a weak point in the design must be termed the numerous window openings, which make it possible for an adversary to shoot effectively upon the defenders from a distance. Likewise the lack of a better means of closing the inner gateway is designated as a defect. According to von Domaszewski's interesting deductions relating to the Gate in

Treves with the reference to Tacitus, all these arrangements were only to be justified, if an outer work before the Gate were assumed; that prevented direct attack on the Gate by the assailants and hindered them from effective shooting.[320]

Note 319. See the same. Jan. 1904.

Note 320. Compare on the other hand, Lehner, H. Zur Entwickelungsgeschichte des Römischen Festungsbaues in Rheinlandes Correspondenzblatt der Westdeutschen Zeitschrift für Geschichte und Kunst. 1904. p. 46.

Figs. 509 and 510 illustrate the present condition of the internal and external sides of the gate.

On German soil, the Gate in Regensburg discovered in 1885 and built into a brewery is not to be neglected, on account of its relationship to Gate Nigra. It was uncovered in 1887 as far as possible (Fig. 507) and appears as a massive ashlar structure of limestone tufa with dressed ashlars 2.89 ft. high and set without mortar. The structure was completed under Marcus Aurelius and it still has the impost moulding of the gateway arch, the well profiled architrave and a part of the cornice on the round tower, to which the objection should be made, that it has too many windows.

In conclusion should be mentioned the Gate Moselle at Treves, which dates from the time of Constantine, and that has at least been preserved to us on coins.(Fig. 508[321]).

Note 321. The coin comes from the collection of M. le Vicomte de Ponton d'Amecourt (Catalogue des Monnaies d'Or Romaines et Byzantines. Pl. 35, p. 663. Paris 1887). It shows the gate flanked by 4 great towers, two of which have 9 stories and two have 8, with a statue of Constantine in the centre. Behind are seen the spires of 3 towers. Below is the Moselle, on the right and left being two captives lamenting. -- A gold coin of the same collection (Pl. 24, p. 627) exhibits the gate of a camp without gate-leaves, with 3 higher towers and 2 turrets, in the background being 2 small towers between 2 larger ones. (I owe this information to my honored friend, Privy Councillor Dr. W. Brambach in Carlsruhe).

On the Gate in Aosta is likewise found the finest jointing without the use of mortar, just as in Treves, but instead of the incomplete mouldings, the rich ornamentation of the Aug-

Augustan period extends over a nucleus masonry od conglomerate stone. The internal main cornice with modillions and dentils consists of white marble. high courses of slabs form the covering below the plain frieze and architrave. The archivolt is decorated by heart leaves and it is in three bands. A view of the present condition of the exterior with a glance at the inner court is given by Fig. 511.

In contrast to these structures in limestone ashlars stands the so-called Palazzo delle Torri at Turin with its perfected brick masonry, which recalls that on the tombs along Via Appia, of the Amphitheatre Castrense, the Sedia del Diavolo, of Deus Rediculus etc. near Rome. (See Fig. 259). The relief on the building is flat, corresponding to the nature of the material, and its dark red color has an earnest and severe effect with its two great gateways. The motive above the passages -- slender round windows between pilasters or half columns as in Treves -- is likewise carried out here, just as in Autun, Fano and other places.

The Roman North Gate in Cologne, like the Gate Augustus in Nimes,(Fig. 502), ekhibits Corinthian pilasters, but these are fluted on the contrary, thereby producing a richer development of the facade. The attempt at the restoration on the basis of the recovered remains of the cornice and capitals of the exterior in Fig. 512 [322] is indeed doubtless correct for the lower portion. even the representation might pass in many respects, if the arches between the columns were constructed in accordance with the well known ancient examples, and if it did not fail in the plan and in every supposition. But entirely inadmissible are the stumpy flanking towers, which are assumed to be lower than the gate structure, with reference to Pompeii and Aosta. But they were assumed higher at both places, [323] and they must also have been formerly so everywhere, if they have one purpose.

Note 322. Published in Cent. d. Bauwesen. 1893. p. 81.

Note 323. Compare Canina. -- Also Promis.

352. Palace Gates in Spalato.

Yet richer than this city gate in Cologne appear the gates, and especially the Gate Aurea in the massive defensive walls of Palace Diocletian at Spalato. Finely built in white lime-

limestone, it is a gateway with simple flanking towers, the openings spanned by a single round arch, which is intersected at the height of the impost by a straight arch (Fig. 505), constructed of indented voussoirs, above which extends a richly ornamented frieze. Over this rises the likewise richly decorated archivolt of the face of the arch. On the right and left of the gateway are semicircular niches, flanked by Corinthian pilasters. Above the first story treated in this manner, rich volute consoles project from the broad dividing belt course, that bear columns in Corinthian style joined by round arches. Between the capital of the column and the arch is inserted as the innovation mentioned, a block of the architrave with its crowning cornice.(Fig. 513). Two of these arch tympanums are treated as semicircular niches, as in the lower story. Thes story, which repeats the arrangement of the Gate Nigra and of other city gates (Turin), at least in idea, terminates with a dry cornice. What was above this can no longer be determined; -- attic or battlements? Cassas [324] delineates the former.

Note 324. See his work.

The emperor Hadrian gave a rich city gate to the Athenians, but which was far surpassed by that in Adalia (Attalia), dedicated to the same monarch. Flanked by two massive towers, it once formed the chief entrance to the city. Three gateways with semicircular vaults 13.61 ft. wide, 20.27 ft. high and 10.91 ft. deep, form the entrances. At a considerable distance from the gate piers stand on pedestals of the Composite order, that support a returned entablature, which is richly covered by ornaments. The soffits of the vaults have shallow coffers, and the archivolts and impost caps are adorned with egg-and-dart mouldings and beaded astragals. The gate is built of white marble, with the exception of the shafts of t the columns, for which granite was employed.

The columns are not set before pilasters; these are only indicated by a capital beneath the architrave. Their shafts would have weakened the effect of the heavy existing piers, and they were accordingly omitted. The dedicatory inscription was placed on the architrave in bronze letters. The substructure 26.34 ft. high with the three gateways, once suppor-

supported a superstructure like the Athenian Gate, which Beaufort saw, but which had already disappeared in 1833 at Texier's visit. Petersen[325] represents the impression of the building in the words:-- "The whole is rich and effective, yet is wrought without refined invention." But the superstructure is wanting to the "whole"!

Note 325. Vol. 1. p. 23).

Note 326. Compare Städte Pamphyliens und Pisidiens, with the collaboration of G. Niemann and E. Petersen, edited by Count Karl Lanckorowski. Vol. 1. Prague, Vienna, Leipzig. 1890.

353. Aqueduct Gates.

Equally effective and only richer in detail is the so-called Gate Porta Maggiore in Rome, a passage beneath the Aqueducts Aqua Claudius and Anio Novus. The triply subdivided attic is covered by a long inscription and contains the channels of the two aqueducts; the massive supporting structure of travertine is built of rusticated ashlars; two round-arched openings, the passages of Via Praenestina and Via Labicana, are arched with rusticated voussoirs and penetrate it. The middle and angle piers likewise have openings spanned by round arches, each of which is enclosed by a shrine, the rusticated shafts of whose columns (it is immaterial whether originally so intended or not) now harmonize with the rusticated ashlars of the wall surfaces and arches, forming an effective contrast to the Corinthian capitals and the richly moulded entablatures and pediments. Below the central opening is visible another, whose sill lies below the present level of the street. (Fig. 515).

The Aqua Marcia has a simpler opening for a street near the present Gate S. Lorenzo. Three channels are carried above each other, the lower one of which is behind the entablature, the middle one is behind the pediment, and the upper one is concealed behind the attic of the superstructure of the Gate. The opening consists of a simple arch, accented by imposts and keystone and with an archivolt in bands, flanked on the right and left by pilasters with capitals resembling Doric, above which rises the superstructure mentioned, consisting of entablature, pediment and attic, adorned by inscriptions.

Fig. 516 gives the cross section of this gate and at the same time exhibits the simple construction of the aqueduct channels.

354. Street Pavements.

Military roads have been preserved for us in all parts of the world, wherever Roman legions marched. Built strongly and well, they are in part still in use today. They invariably consist of a thick foundation of stone rubbish and spalls, that bore as a covering a layer of pure gravel or one of mixed gravel and sand.(Fig. 517).

Instead of the latter, there occurs on the great traffic roads a solid covering of hard kinds of stone (granite, lava, hard limestone), whose slabs were wrought in polygonal form and carefully jointed together.(Via Appia, Roads at Vienne, and others; compare Fig. 518).

355. Mile Stones.

The distances along the roads were made known to the traveler by numerical indications, first indeed on the military roads. According to Plutarch, Caius Gracchus first had mile stones with numbers set. Each of these indicated the number of miles it was distant from the capital; **local** starting points were taken for the provincial numbering of the miles. At the entrance of the Roman Forum, below the Temple of Saturn, Augustus had erected the Golden Mile Stone -- Miliarum Aureum. Milestones usually had the form of a cylinder about 7.87 ft. high (Fig. 519), sometimes adorned by base and capital. The "Augustan" consists of a square plinth, and the cylinder with a base and capital, crowned by a sphere with a point. The mile stones were set at distances of 1000 (Roman) feet, the numbers being expressed in paces.[327]

Note 327. Among others, mile stones are preserved: -- in Museum at Wiesbaden, from the period of Elagabalus and Aurelian, (270 A. D.), the latter (6.56 ft. high and with inscription) found in the Rhine near Salzig. The inscription states with other things: --"20 Gallic miles from Mentz." -- Others are found in the Museum Provincial at Treves (Nos. 94 - 97), that date from the times of Antoninus Pius (139 A. D.) and of Hadrian (121 A. D.). (Route from Treves to Cologne). -- Another with inscription of the year 212, on which the distance is given in "leagues", a Gallic measure of length, which was 1500

paces equal to 7275 ft. (One pace or double stride is reckoned equal to 5 ft., the Roman foot equal to 0.971 ft.; the pace thus being equal to 4.851 ft.; hence 1000 paces equal about 1.38 miles). -- Also others on the Rhine go back to the time of Constantine.

356. Sidewalks and Width of Streets.

The slightly crowning driveways in the cities were bordered by the raised curb stones of the higher sidewalks; stepping **stones** inserted in the driveway provided a connection of one **sidewalk with the other.**[328]

Note 328. Compare Mazois, -- Also Overbeck, p. 59; lastly Mau. p. 28, 210.

Behind the curb stones 0.98 to 1.31 ft. wide, the walks (on the right and left of the driveway) were constructed of tamped earth, of sand, bricks, or of ordinary limestone and tufa or of marble slabs, according to whether the owner of the house was willing to spend more or less therefor, as he was required to build and maintain them. The borders were made as curb stones. The rain water on the streets ran off through various outlet openings in the pavement into underground sewers and was thereby carried out of the city. (See Chapter 14; Sewers). The pavements of the streets in Rome was constructed relatively late and gradually, so that not one existed in the year 45 B. C. in the entire city.

The width of the streets in Pompeii varies from 9.84 to 19.69 ft. and even goes to 31.43 ft. For the latter breadth, the division into driveway and sidewalks was made and all are paved. Only in the principal streets could two wagons pass beside each other; the street crossings in the others must be be used for passing. Everywhere in the pavement may still be seen the grooves cut by the wheels, which in Pompeii are more ancient than in the city of Rome and date from before the year 44. B. C.

The stepping stones mentioned were large and of oval form, rising above the pavement to the height of the sidewalks, up to five in number, according to the width of the street. Space must be left free for the wheels. That it was possible for draft animals to pass between them is explained by Mau from the ancient method of harnessing, when they were only attached

to the end of the tongue by the yoke, and thus they could freely move their hinder parts.

357. Traffic.

Streets for traffic, where shops adjoined each other, and quiet streets with solid facade walls only penetrated by the house entrances were just as common to ancient cities as to those of the middle ages and of the modern period.

Rapid driving of chariots with persons -- but not the passage of loaded wagons -- was not permitted within the city. Caesar forbade driving in the streets of Rome during the first 10 hours of the day; it appears to have been generally forbidden in Pompeii. Instead of chariots, persons of consequence employed litters borne by slaves.

358. Street Lighting.

A systematically carried out lighting of the streets was indeed in use in the fewest cities in antiquity, although it is stated of Antioch, that in the 5 th century A. D., the splendid streets with columns were lighted in the brightest manner and were then more animated than during the day. History is silent regarding the "method". In imperial Rome and before public buildings, pitch or resin was indeed burned in basins for lighting the vicinity, or on festal occasions candelabra were placed on the public places; yet the inhabitants of the city generally limited themselves in traversing the streets by night to the use of torches of reed pith soaked in fat and to wax candles after the 4 th century A. D. Those returning home from a banquet had the way lighted by their slaves with torches or lanterns, as sometimes is still the case in the East.[329]

Note 329. Also compare Merckel. p. 7.

359. Representation of Streets and Cities.

According to all this, what was the appearance of the streets in the interior of the city? The public buildings, the monumental theatres, amphitheatre, the forum with its porticos, the temples with their sacred precincts, the basilicas, the baths, the monuments, the memorial arches, the equestrian figures and statues, etc., are indeed determined, and especially their magnitudes and number, the more or less noble appearance of the city, its architectural and artistic expression,

while the private residences receded into the background, contrary to later ideas. The dodern "white wall" raised again on the shield as the ideal of civic architecture had its justification and its sense in the conditions at that time and in the mode of living, and we should not have too lofty conceptions of the appearance of the tall rented barracks and houses in the great cities of that period. Men rather expended their good money for the beautiful furnishing of the interiors. A street view in the provincial city would therefore have appeared neat with this preferred mode of building in a single story, and one may indeed illustrate this by one such of Pompeii, as Fig. 520[330] gives before the destruction of the provincial amazon in a neck-breaking two horse chariot driving over the pavement be omitted, for driving at a gallop or with the chariot was officially forbidden in Pompeii, as already stated. But the view is otherwise intelligible and conceived with actual knowledge of the matter; it has the local tone and good artistic worth, like all the drawings in the corresponding work. And if we wish to place ourselves under the charm of the capital of the world, then must we recall the wonderful cyclorama of Bühlmann and Wagner, described by von Reber (Munich, 1888) -- Rome with the triumphal procession of Constantine in the year 312 -- which was a masterpiece of architectural drawing and of coloring, an architectural work of the best kind, produced by thorough study.

Note 330. After Weichardt, C. Pompeii vor der Zerstorung. Leipzig. 1897.

And now for the exterior. A privincial city surrounded by walls and towers indeed presented to persons coming from a distance no highly elevated appearance, especially if it lay on a plain. Its effect in a hilly country or on the slopes of a mountain must be designated as better, in accordance with our feeling. But what lends to every city its ekpression is the forms of the roofs of its houses and their extension in height, which produces a more or less animated sky line. Antique architecture only knows the low roof, the absolute equilibrium between the forces acting vertically and horizontally on the building, and the current emphasizing of this in the form, which is then likewise expressed in the sky

line of the city. The view of the city of Timgad (indeed without roofs; Fig. 521) now shows a harmoniously intended whole, if we are able to mentally supply the destroyed parts, over which nothing predominates in an ungraceful way, an image of quiet and uniformity.

The tall column is again subdued by the horizontal architrave, and the aspiring mass of the building by the flat roof. This is combined with the uniformity of all buildings, which the view of a city comprises, and impresses its characteristic stamp on it.

Thus for the western Roman cities, which must have been essentially different from the eastern Roman at a certain time. In place of the juiet forms of the roofs appear those with tunnel and domed vaults, which afford soft and wavy outlines instead of the rigid zigzag lines, and from which arise forth the domes of important buildings like lofty and angry waves. (Compare the view of Koum in Fig. 522[331], which although Persian, may yet present the image of an eastern Roman city).

Note 331. After Dieulafoy, M. L'Art Antique de la Perse. Vol. 2. Paris. 1884.

The view of a mediaeval city presents an entirely different appearance, on the contrary; an eruption occurs instead of peace. Like random and fanciful basalt pillars appear the towers of the nobles, breaking through the still peaceful lines of the private houses, one desiring to be larger than the others. If one be lofty, then the other must be yet higher -- a personification of the polictical events in the small city republics.(Fig. 523). To these are added the churches towering above everything by their towers and domes, and permitting the view to be still more animated, as for example, the incomparable outline of the city of Florence, than which one more picturesque and refined has never matured.

What the very latest art offers in the new world is shown by a partial view of the city of New York.(Fig. 524). Which deserves the palm?

Chapter 14. Works for Water Supply, Bridges and Sewers; Public Privies.

360. Cisterns and other Water Reservoirs.

In cases where it was impossible to provide good water for drinking by means of aqueducts, rain water was collected for this purpose in specially constructed cisterns.[332]

Note 332. Compare Jahresb. d. K. K. Marine-Unterrealschule in Pola. 1900 - 1901. Römische Wasserversorgungsanlagen im südlichen Istrien. By Anton Guirs.

"Although the ancients pronounced properly preserved rain water to be the best and healthiest drinking water (Vitruvius. Book 8, 2, 1), they saw themselves compelled in most cases to feed their water supply works with water drawn from the earth, or with cleared and purified flowing water and to dispense with the collection of rain carried out on a great scale.[333]

Note 333. See the same. p. 8.

Water from cisterns and springs, and also frequently flowing water, was therefore utilized, or subterranean collecting basins were excavated for this purpose. The water was conducted in pipes, in open or covered channels, to special reservoirs, from these being further distributed.

Cistern structures are yet shown in sufficiently large number in the broad Roman empire. Vitruvius and Pliny speak of them and of their construction (Vitruvius, Book 8, 6; Pliny Natural History. Book 36, chapter 52). Both require for the waterproof construction of the cistern walls and for the construction of enclosures and floors the opus signium with a smoothly polished plastering over the same, to which was added finely pulverized tiles or potsherds and marble dust.

On a smaller scale, we find for providing water for farmyards and for even larger places, the arrangement of cisterns in great number on the western coast of northern Istria, one of which -- near "Stanza Barbariga" -- is illustrated in Fig. 525. The external walls are 4.92 ft. thick and are built of rough stones, like most others elsewhere, which are covered internally with opus signium 3.28 ft. thick and extending 9.19 ft. high, enclosing a rectangle 82.02 ft. long and 41.17 ft. wide. The floor is constructed of the same materials. The sharp angles between the vertical surfaces of the walls and

the horizontal floor are rounded off. The concrete masonry shows a mixture of limestone pebbles, gravel of nut size, and mortar with an addition of puzzolana earth. The plastering mortar exhibits a considerable mixture of fragments of bricks and of potsherds in pea sizes, the last coat of the layer having an addition of the finest marble dust, which is polished like a mirror. The space for receiving the water is divided by rectangular piers into three aisles, which are spanned by semicircular tunnel vaults, a mode of construction indeed compelled by circumstances. There was required the greatest possible height of the vertical external walls with the least height of the structure itself. Flat vaults of wide span were not risked; with semicircular ones of complete arched form, the vertical enclosing walls were indeed omitted. Water entered and ventilation was provided by openings in the middle tunnel vault. For drawing off the water, there served an opening 5.91 inches wide into a channel, with a box for sediment before it. The manhole to the vaults is found at an angle of the plan.

As collecting surfaces for rain first served the roofs, which covered the cistern like the Tuscan impluvium. Since this cistern roof alone sufficed in the fewest cases, it must be conducted from the adjacent buildings. The cisternsmentioned by Guirs[334] contained from 530 to 27,512 cubic feet, according to dimensions.

As evident from the design and construction, the cisterns of Fermo (the ancient Fermum) dating from the time of Caesar were only intended for the collection of rain water. It was received in rectangular vaulted cells, each 29.53 ft. × 19.69 ft. and 17.06 ft. deep, which were built of unusually perfect opus signium and were plastered with hydraulic mortar up to the springing. The cells were connected together by openings 8.70 ft. wide and 4.92 ft. high; the water entered the interior through square openings.[335]

Note 334. See Guirs.

Note 335. Compare Annales de l'Institute de Corresp. Archaeol. 1846.

We find cisterns for the smaller requirements of houses everywhere, wherever roofs inclined toward the interior were constructed.

Pompeii did not omit cisterns, in spite of its aqueduct, the source of which is to be sought on the northern slope of Vesuvius, and which supplied Naples, Puteoli, Baiae and Misenum. A reservoir 49.21 × 13.12 ft. within the city was intended to supply water in case of need (the aqueduct might fail for natural reasons or be cut by enimies during a siege). To the same reasons the great cisterns in the Eastern-Roman capital--at Byzantium 66 owe their origin, as well as the great preroman cisterns in Carthage.

A rectangular place at Aosta is 120.7 × 292.6 ft. and it is surrounded on three sides by subterranean vaults over two aisles, altogether 25.98 ft. wide (Fig. 526, b), that we must likewise regard as great water reservoirs. What remains at present is accessible with difficulty and is correctly represented in Promis' work.[336] (Plate 8). In the autumn of 1902, I found the pier embedded in the damp earth, the middle arch but slightly projecting beyond it; but so much louid still be determined by the light of a candle, that Promis' statements must be regarded as trustworthy, like all others of his publications in reference to Aosta. He holds the vaults to be a granary or military magazine and places over it a gable roof[337] (Plate 9), whose ridge rises not quite 26.25 ft. above the external pavement, while the smooth and plain walls are only interrupted along one side by small openings for light.

Roman granaries ("horrea") as now, were not cellars sunk in the damp earth, but were rather lofty buildings in stories, (see chapter 20), which permits me to assume that we do not have to do with a granary here, but rather with a great cistern for supplying water. Under the critical conditions, which prevailed there between the Roman garrison and the Celtic Salassi living outside, great reservoirs of drinking water were indeed a necessary precaution.

Aosta possessed a stone theatre and a similar amphitheatre, both of which are preserved in very important remains; it likewise had a market and a temple precinct. Within the place surrounded by the cellars mentioned, Promis found the substructures of three temples. Might not the cellar walls have supported a stoa in two aisles without interfering with their purpose of enclosing extensive water reservoirs? The Temple

of Castor at Rome likewise utilized its substructure for similar purposes, and we find the like temples on African soil, where the rain water was collected in cisterns beneath the house of the deity. A granary or cellar structure with plain walls and low roof is for me a quite conceivable enclosure for a temple pricinct.

A nearly allied design was published very recently[338], which was discovered in Faicchio, and that can only be regarded as a water reservoir of great extent.(Fig. 526, a).

Note 338. In Notizie degli Scavi di Antichita. 1895.

We likewise find extensive cistern designs in imperial Rome near the Baths of Titus with an area of 137.80 × 183.73 ft., which are entirely constructed of dressed stones and indeed only intended for the reception of tempered water.[339] Similar to these are also the cisterns built in Julia Caesarea (Cherchell) in Africa. There may likewise be mentioned here those in Cirta, Hippone, Rusicada, and Stora.(Algeria).

Note 339. Compare Canina. Plate 172. Fig. 4.

The colossal ancient cisterns at Carthage were restored after the destruction of the city by Caius Gracchus in 116 B.C. A second restoration was made in the year 1887 of the gigantic tunnel vaults of the Malka and Bordji Cisterns, to both of which was conducted their water from the springs of Zaghonan and Djoukar by an aqueduct over 62.14 miles long. The Bordji Cistern is not so large as the Malka, but it shows 18 tunnel vaults, each 98.43 ft. long, 24.61 ft. wide, and 29.53 ft. thick!

Imposing are the vaulted water reservoirs in Puteoli, the vaults of which were supported by 3 rows of pillars in width and 10 lengthwise.[340]

Note 340. Compare Paolini, A. Antichita de Pozzuoli, Cuma e Baja. Plate 21.

But the grandest design is that near Baiae or Bacoli and known under the name of "Piscina mirabilis". It forms the termination of the Julian Aqueduct and is a structure 232.94 ft. long and 88.58 ft. wide, whose vaults rest on 48 piers, that divide the extensive interior into five aisles, down to which lead two stairways of 40 steps.(Figs. 527, 528). Here was stored the drinking water for the Mediterranean fleet, that

was stationed in the harbor of Misenum.

The Piscina Mirabilis already covered an area about 20,635 square ft., but it was then surpassed by the Cistern of 1001 columns (Bin bir direk) in Constantinople with an area of 165.84 × 196.85 ft. = 32,654 square ft., according to all probability identical with the Cistern of Philoxenus built under Constantine the Great and dating from the first half of the 4 th century.

361. Aqueducts.

The collection from springs in the mountains and the conducting of the water to the intended locality, which were often miles apart, sometmies required the water channels to be cut in hard stone or in soft soil permeated by the ground water, as well as the tunnelling of rocky precipices for long distances, then to carry the channels on piers and arches over rivers, valleys and bridges, which altogether placed requirements before the state and its engineers, which were scarcely to this extent demanded of or executed by any other people of antiquity. We here learn to understand the words of Friedlander:[341] -- "Architecture is the only art, which the Romans creatively treated as allied to their national genius, the sole one that could not merely serve the great purpose of the state, the empire of the world, but which could produce an expression of the idea of the "world empire." Dependent in all other domains of art upon Grecian influence, it here created with entire originality those works, that in spite of thousands of years produce such a mighty and almost awful effect,[342] beside which Grecian art can place nothing."

Note 341. See Vol. 3. p. 302.

Note 342. See Semper. p. 479 - 486.

These Roman buildings "have a royal supremacy, even beside the most massive, that Italy possesses from the mediaeval and and modern architectural periods,",[343] strikingly adds Burckhardt. (p. 10).

These monumental aqueducts also frequently included settling basins of great extent, and some of these previously designated as collecting basins must also have served as settling basins. One does not exclude the other purpose; for in time of need, the settling basin could also become a reservoir.

For these aqueducts, men chiefly employed a construction on masonry piers and arches, extending above these the channels of rectangular section, also of masonry, covered in gabled or semicircular form, with a slight inclination, sometimes with two or three above each other.(Figs. 515, 516; Gate Maggiore at Rome). Thus the slope of the Metz Aqueduct is 1 in 280 and the fall of the Aqua Appia is 175.81 ft. from the mountain to the city, the Aqueduct from Ariovistus to Rome has a total fall of 425.42 ft.(Beginning is 600.24 ft. and the end in Rome is 174.73 ft. above sea level).

The water channel of the Aqueduct of Macrinus near Naples with a height of 6.56 ft. is covered in semicircular form, has vertical walls and a floor of funnel shape. At Pont-du-Gard, the channel is 6.40 ft. high and 4.43 ft. wide, but the width of the passage is reduced to 1.14 ft. by limestone slabs. Arches and piers are entirely without ornament (Fig. 529); Aqueduct Claudia near Rome), and the latter are generally built of constant dimensions from the ground to the impost.

More beautiful to my sense of feeling than these in the mother country are the diminished piers of the Aqueduct near Ars-sur-Moselle with their stepped form (Fig. 530) and likewise those of the Spanish aqueducts at Segovia and Chelves. The piers in Segovia are built of a kind of granite without mortar with a maximum height of 101.7 ft. Those in Maida bear on their external surfaces pilaster-like projections of peculiar form.[344]

Note 344. Compare Merckel.

362. Pipes under Pressure.

Syphon aqueducts were employed, even if in the rarest cases, while pressure aqueducts are only known in Alatri, Lyons, Pergamon, Aspendos, and Arelatum (Arles). In Alatri, the water was conducted from the collecting basin at Mt. Pajelli, which is 6.56 ft. higher than the outlet in Alatri, across the valley 331.28 ft. deep in lead pipes of 3.94 inches diameter. It was led into Lyons partly underground, partly on arcades, and then through a tunnel, over the deep valley of Pouillet and thence by means of a syphon, which rests on an arcade of 13 arches. In like manner was the water conducted across the valley of the Garonne by a syphon with a rise of 308.41 ft.

The essentials of this aqueduct are shown by Fig. 531. On the same principle of the syphon are based the Turkish and Arab aqueducts still in use in Constantinople and Palermo.(Suterasi or water-pier, literally "water-wagon."). The arrangement has the great advantage of increasing the force of the water in the subterranean channels and disturbances of the flow of the water, i.e., any obstructions in the aqueduct, may be more easily found and removed. Masonry piers in the form of a truncated pyramid support an open reservoir, in which the water level is assumed somewhat higher than it is at the inlet from the source. The flowing water ascends to the reservoir on one side, flows into it and then falls against a current of air on the other side, in pipes down to the ground channel.

Finally, it should be stated in reference to the abundance of water in the city of Rome, that during the period from 74 to 104 A.D., nine aqueducts were in use, with 14 at the time of Procopius (died 565), through which passed daily to the city the following amount of water:--

52,562,281 cu. ft. according to Rondelet.
33,551,150 cu. ft. according to Belgrand.
21,967,174 cu. ft. according to Herschel.

On account of the illegal taking of water on the route from the source to the city, an average quantity of 8,016,959 cu. ft. may be assumed, or 60.77 gallons per person.

363. Aqueduct Bridges.

These aqueducts caused the erection of a great number of bridges of most striking prominence. Thus for example, the Pont-du-Gard is a portion of an aqueduct for supplying water to Nimes. The lower passage of the bridge is a later addition dating from the year 1747. It connects the two banks of the Gardon by an arcade 861 ft. long and 155.47 ft. high on piers, and it crosses the bottom of the valley by 6 arches of unequal size in the lower story, 11 arches of different spans in the second, and 35 arches of 15.72 ft. span each in the third, which support the channel covered with slabs.(Fig. 532). The piers are 19.69 ft. wide in the lowest story, 14.76 ft. in the next, and 9.84 ft. in the uppermost, built of great ashlars set without mortar. Destroyed in the 5 th century during

the invasion of the barbarians, the Pont-du-Gard was extensively restored in 1855 -58 by Questel and Laisne:-- "The monument, without losing anything of its character, has recovered its original appearance and its beautiful proportions." The additions made in the year 1747 still serve the same purpose as formerly; the restoration and preservation of the work therefore has a meaning and sense. Lovely it stands in the severe landscape with the rocky banks, and majestically with the trees extending down into the water, as a token of a great past and a grateful present.

Concerning the construction of the arch in three rings of masonry, the jointing of the stones, the arrangements for the scaffolding, and the projecting stepping stones, everything necessary has been previously said in Art. 204. The separating basin (dividiculum) belonging to the aqueduct was discovered in 1844.[345]

Note 345. On both compare also; Archives de la Commission des Monuments Historiques, published by order of his Excellency, M. Achille Fould, Minister of State. p. 1 - 6. Paris. 1856.

A peculiar form is shown by the Bridge near Aosta, built under Augustus and called "il pendel".(Fig. 533). Over a nearly semicircular arch, that is 49.21 ft. wide and extends from one bank to the other, there rises a passage furnished with holes on each side, and which has a separate entrance gateway at the side on each bank. The passage is rather more than 3.28 ft. wide and is 9.61 ft. high, over it being a walk somewhat longer than the covered passage, enclosed by low masonry parapet walls.(Fig. 533[346]). Both serve private purposes, which indeed partially explains the small width of the bridge. The work is proved genuine by two inscribed tablets set above the crown of the arch.

IMP. CAESARE. AUGUSTO. XIII. COS. DESIG.
C. AVILLIUS. C. F. C. AIMUS. PATAVINUS
PRIVATIM.

Note 346. Compare Promis. Plate 14.

Built of opus incertum, only the voussoirs, the enclosures of the gateways and the floor slabs being of dressed ashlars, which still bear on their faces the holes for splitting. Promis quotes a statement of Pingone.(1550), "above was another

bridge, where was an aqueduct. The water flowed from the west toward the east, and there was a tube of lead." -- But he will not give up the purpose of the covered passage for a walk 164 ft. long from one bank to the other. He misses in the passage opus signinum in order to recognize it as a channel for water. But this is not necessary, if the passage only bad to receive one or even two lead pipes beside each other, as they are found everywhere, and which we recognized with a diameter of 3.94 ins. in Alatri. We must than assume here, as at Pont-du-Gard, a walk for persons on foot, above, underneath being the protecting passage to receive the lead pipes, where any leakage of the aqueduct may easily be perceived, and its repair be directly undertaken. With the mighty example of a city aqueduct is contrasted the small one for a private aqueduct.

364. Bridges with Driveways.

But never as rich in any case are the bridges intended for the passage of men, animals, and traffic wagons, with which with which architecture as an art was concerned within the cities divided by rivers. According to the breadth of the river, one or more passages were left for the watercourse, the piers in the stream were furnished with projecting masonry breakwaters, and the bridge arches were constructed in the form of segmental or semicircular arches. The voussoirs set on the faces are mostly plain ashlars (Rimini, Bridges Rotto, Nomentano and Salario at Rome), but others are again of moulded stones (Narni)5 the spandrels between the arches are decorated by shrines in a splendid way (Rimini, Fig. 534), or openings vaulted in semicircular form are there found, which only begin above the imposts of the arches, or the great middle arch is flanked by smaller ones at the sides.(Bridges Molle, Fabricio and Cestio, Rome). The balustrades, as a rule, consist of plain stone slabs or of pedestals with slabs set between them.(Fig. 535; balustrades from Bridges de Vaison and 347 Salario, the latter also illustrated in the work mentioned below). Ornamentation by gateway arches at the entrance to the driveway is not excluded, as shown by the Flavian Bridge of S. Chamas (Fig. 536) and of Bridges of Alcantara. That of S. Chamas has at the entrances two gates ornamented by Corinthian pilasters, those of Alcantara having a simply treated one

over the middle pier of the bridge without any ornamental decoration.[348] The gate opening as a passage with a width of 16.4 ft. and a height of 26.80 ft.; the driveway is 19.69 ft. wide and lies 131.24 ft. above the level of the water. The ashlars are mostly 1.64 ft. high and consist of headers and stretchers with drafted margins and bosses 1.18 to 1.58 ins. high. The three middle piers in the stream have breakwaters on one side; they end in rectangular form at the other. The inscription on the otherwise plain attic reads:--

IMP - CAESARI - DIVI - NERVAE .
F . NERVAE - TRAIANO - AUG - GERM.
DACICO - PONTIF - MAX.
TRIB - POTES - VIII - IMP - V - COS - V - P - P.

Note 347. Rossi. Fig. 23.

Note 348. Compare Monumenti Inediti. Vols. 6 and 7. Rome. 1857 - 1858.

This Bridge over the Tajo (Tagus ?) was built of granite without mortar by Caius Lacer (98 - 106 A.D.). Near the entrance stands a little temple (bridge chapel; see Chapter 18), in which the bones of the builder were deposited -- as a token of honor for his act! One arch next the bank was first destroyed in the middle ages; the English blew up another arch in 1809, and the Carlists destroyed the entire bridge in 1836; it was again restored in 1860. The greatest arches have a span of 85.3 ft., and the smallest one of 37.72 ft.

In imperial Rome are to be mentioned Bridge Aelius (136 A.D.), but of which only the three middle arches are indeed ancient, then from the earlier period Bridge Aemilius, of which only a single pier still stands (built 179 B.C.); further the famous double Bridge, Fabricius and Cestius, which led to the island in the Tiber, which in ancient times had a complete enclosure of travertine in the form of a ship, remains of the stern portion of which are ornamented by sculptures and are still preserved. (Fig. 537[349]). Indeed once a magnificent part in the view of the city! Fig. 9 affords information concerning the mode of setting the stones of this bridge. In order to make the vaults as secure as possible and to relieve the centering during the construction, they are constructed with a superfluity of iron cramps in cast lead.

At the rebuilding of the bridge, the Italian architects declared that this method had injured the durability of the bridge (after 2000 years !). Left in peace, it indeed would have endured for other centuries. Its foundations lie 4.99 ft. below low water and consist of concrete surrounded by a double row, 3.6 ft. wide, of driven oak piles, directly above which commences the construction in travertine.[350]

Note 349. Also compare Ann. d. Istituto d. Corres. Archaeol- 1867. p. 389 et seq., and plate d'agg.k.

Note 350. Compare Hülsen, Ch. Jahresb. über Topog. d. Stadt Rom. Mitt. d. Kais. Deutsch Arch. Inst. Röm. Abt. 1899. p. 282 et seq.

Among the great works on German soil should be mentioned the Bridge Moselle in Treves with a span of the arch of more than 65.6 ft., whose piers are built of blue limestone without mortar. Only the latter are indeed Roman, the arches above them having been constructed in 1729 by Elector Franz Ludwig.

As an interesting structure may further be added the single arched Bridge S. Martino near Aosta (Fig. 538) with its span of 116.77 ft., which is built not quite 19.69 ft. wide and has a steeply inclined driveway from each side. The bridge arch consists of 5 rowlock ashlar arches, separated from each other by opus incertum, and where the voussoirs do not radiate from a single point, but from two centres. The arch commences with approximately horizontal stones, that at first rise but slightly and only in the vicinity of the joint of rupture, do they range toward a centre, which is to be sought below the centre at a distance equal to 1/3 of the span. The parapet walls are made of plain stones, the driveway being of polygonal stones, as for the great military roads.

365. Works for Display of Water.

In conclusion may be considered the "reservoirs" (castella, dividicula) -- lofty and magnificent structures, in which the distribution of the water was made for public and private purposes. They were very numerous in Rome, if we recall that Agrippa alone had constructed 130 of these richly decorated buildings. Earlier termed "dividiculum" and later "castellum", such a building should contain three reservoirs of equal dimensions, one of which supplied public fountains and basins, the s

the second the Baths, and the third the private houses.[351] A view of a great design may still be afforded by the remains of a reservoir in Side in Asia Minor.(Fig. 539[352] Similar to this in plan was the Septizonium of Septimus Severus.(Figs. 540, 541[353]). It consisted of three nearly semicircular niches, ending at the right and left in projecting wings, the eastern one of which was still preserved in the 16 th century. A singular structure like a tower with three rows of columns above each other, of very airy and rash construction, adorned by costly granite and some kinds of marble, whose facade was ornamented by columns set before it, its middle niche being decorated by a colossal statue, the whole having a total length of about 315 ft.

Note 351. Compare Daremberg & Saglio. Dictionnaire des Antiquites Grecques et Romaines. Part 6. p. 396 et seq. Paris. 1879. -- Further, the distributor (dividiculum) for Nimes near the Pont-du-Gard, already mentioned, and a similar arrangement still existing in Constantinople; -- lastly, Bassin de Division des Eaux a Nimes. Archives de la Commission des Monuments Historiques. 1856.

Note 352. Reproduced from Lanckoronski, K. Städte Pamphyliens und Pisidiens. Vol. 1. Plate 30. Vienna. 1890.

Note 353. Compare Hülsen, Ch. & P. Graf. Das Septizonium des Septimus Severus, an ornamental observatory on the Palatine, facing Via Appia, destroyed under Sixtus V. Berliner Winkelmanns Programme. Plate 4. (1866).

Hülsen and Graf explain by text and illustrations the Septizonium as a purely ornamental structure, made prominent as a vast theatrical decoration, in order to astonish the country people traveling along Via Appia from Africa, the native country of Septimus Severus. Even if he himself had not needed to add the three colossal fountains as ornaments and parts of the building, if the similar structure did not exist in Side, and the Romans were not such terribly practical and sensible men, this conception might indeed possess some attractions. A “seven-banded structure” in the sense of three niches and the fountain basins standing before them is likewise afforded by Side.[354] To desire to seek the seven bands in the horizontal subdivision would destroy the actually

clear organism of the columnar orders.

Note 354. Compare Tremaux, P. Explorations Archaeologiques en Asie Mineure. Side. Plates 2, 3. Paris.

Maas [355] desires to separate the Nympheum and the Septizonium; for not all water structures of every kind were nympheums, but only sanctuaries of the nymphs, i.e., fountain houses serving for rest and luxury. A free water facade was never a nympheum. Therefore in the case of the Septizonium of Septimus Severus, we have to do with neither a nympheum nor a reservoir. Mass also takes up the evidence that "Septizonium" is a debased concurrent form of "Septizodium". But the latter is shown to denote a building dedicated to the seven planets in their characters as gods of the day, -- a house of the planets or of the gods of the day, and Severus' portico structure therefore supported the seven statues of the group of gods, visible afar from the Via Appia. The Septizodium structures originated on Grecian soil and were afterwards transferred to Rome and Africa. Maas refers in his statements to the "Capitoline Plan of the City," on which the plan of the Septizonium is preserved, and he gives a reproduction thereof, [356] (p. 4), according to which the total length of the building amounted to about 311.69 ft. with a width of about 45.93 ft., and according to well known drawings of the Renaissance masters, it had a height of about 98.43 ft. The niches of nearly semicircular form, flanked by projecting parts at the sides, are required by the plan. Before the wall surfaces stood columns, before each pier being four and six within each niche, exclusive of the angle columns. This is also retained by Graf's restoration. But now follows a not immaterial difference between the city plan and the restored plan, particularly in the projecting side wings. These are fixed by Graf at 3 columns within and 3 with an anta on the outside, while the city plan has 4 columns within, and thus the end piers project about twice as far. A further lack of agreement is shown by the central niche, on the rear wall of which is drawn a pier in the city plan, whose front surface is set in the same plane as the columns, so that two columns are also omitted in the middle niche. Graf draws the middle niche in conformity to the side niches and places the pier before the columns. He likewise draws circular basins

within the niches and a balustrade from one end pier to the other. The former does not exist in the city plan, but the latter is there given. It may have served as the front wall of a basin; but it may also indicate a stepped structure in front. The inserted basins are not considered with reference to the existence or non-existence of a basin. We therefore give up nothing, if we firmly adhere to this, since we have just as little compulsory proof for a stepped structure.

Note 355. Maas, E. Die Tagesgötter in Rom und den Provinzen. Berlin. 1902

Note 356. The same. p. 4.

Why is the difference between the city plan and the restoration? It must solely result from the drawings of the Renaissance masters. Serlio (Book 3) gives the small projection of the angle pier, and likewise the engraving by Duperac; then follows the hand drawing of an unknown Italian of the 16 th century,[357] who gives a view of the northern end and the"plan"of the Septizonium of Severus. But nothing in this plan of the "Setenzuoal" recalls that of the Septizonium, which is termed a "simple doubling (sic); further the "diamond paneled ashlars" of the ground story there given and designated as remarkable, certainly never existed in this form, since in general the entire plate must have nothing to do with the building of Severus. -- in spite of its title. We must indeed assume that Serlio and Duperac did not imagine everything; but according to all these masters elsewhere drew and published of antiquities, they must further be taken as inadmissible. So much is now certain, that if the Capitoline city plan is correct, the drawings in the 16 th century and every restoration based on them must be incorrect.

Note 357. See Egger, H. Kritische Verzeichniss der Sammlung Archaeologischer Handzeichnungen der K. K. Hofbibliothek. Plate 4. Vienna. 1903.

To assign the "House of the Planets" as the nearest occasion for the building does not exclude the addition of waterworks to such, since it is not opposed to the city plan of it; for neither the pier in the middle niche, nor the enclosing parapet wall form an obstacle, the latter being rather another reason for it. Water basins within the great basin are

thought to be rather modern, but are still acceptable.

In Side, water spouts are found in the niches, and in the manner given by Petersen and Niemann[358] are certainly correct, (Fig. 539), but not the bath-tubs under each spout in the drawing by Tremaux. The plinths of the columns at both ends project about 31.5 ft. with a breadth of 7.45 ft., and between these wings might be located the ruins of a front enclosing wall, which with the decorated rear wall, the parts at the sides and this low front wall, enclosed a basin measuring 4805 to 5382 sq. ft. This structure is designated as a "Nympheum" by an inscription,[359] and for another building of similar nature in Lambaesi's (Africa), the inscription "Nymphaei Opus" is proved.

Note 359. Compare Petersen. p. 114.*

The false palace or ornamental wall might be termed a Septizonium, according to Petersen,[360] and the basin a nympheum, both together "as the most imposing treatment of the fountain house!" In the 2 nd century A. D., the Septizonium became a regular ornament of the larger cities.(Compare Perge, Aspendos and many others). Therefore why not the same combination for the contemporary magnificent structure in Rome -- the Septizodium or Septizonium, in the shade of which men could enjoy recreation and coolness?

Maas also wishes to consider the building and the "free space" before it as a whole and as forming a unity. The free space shown in the city plan might as well represent a water basin as a ground area covered by stone slabs.

That both must be considered as a whole indeed appears without doubt; Maas only goes a step further, when he says:-- The building does not express the needs of life; the central niche received the statue of the emperor; but must the massive "side porticos" have served the same purpose? Yes, as a massive substructure, that had to support what must be visible afar from the Via Appia; the seven statues of the group of gods! The substructure arranged like a portico must have had a flat top, the three niches must have ended below the highest architrave, and this must be accepted as permissible on the basis of the example in Side alone. What Graf represents in Fig. 540 is not designed in Roman style, in my opinion, it is not restf

restful at top, and it is more like a modern skyscraping warehouse facade, in which as many show windows as possible are to be obtained. It has nothing of the monumental quiet of the works in the city of Rome. If a superstructure like that at Side be taken as a basis, and one recalls the decoration of circular structures by half domes and by wall columns in the Tomb of Diocletian at Spalato, harmonizing with Side, in combination with the statuary ornamentation proposed by Maas, an acceptable representation may perhaps be obtained. (Compare the attempt in Fig. 542).

366. Victory Fountain of Domitian.

In the present condition of the triumphal arches, we have forgotten that properly these were only intended as richly decorated substructures for supporting triumphal monuments; we have become accustomed to regard them as completed entireties, while the principal part is really lacking. The bronze triumphal ornamentation alone made them what they were intended to be, and thus the Septizodium likewise first becomes intelligible by the ornamentation with the figures of gods as the highest purpose above a rich and massive substructure, which maght be animated by waterworks. If it be stated, "that the Septizonium of Septimus Severus must have formed a new entrance to the palaces on the Palatine," then is rather the reverse true-- an obstruction without an entrance! " A modest design of this kind," Petersen terms the still existing ruins on Piazza Vittorio Emanuele at Rome, called the "Trophy of Marius", from which formerly poured the water of the Julian Aqueduct. The background was formed by a great apse between two open arches -- in which indeed stood the statue of the emperor, while in the arches were placed trophies, later removed by Sixtus V and placed on the balustrade of the Place 361
of the Capitol, whey still are.(See Chapter 23). Maas designates it as a water reservoir in two or three stories for the ancient Aqua Julia, that supplied the Esquiline with water. It may be seen on an engraving of Duperac , it being there represented, that these trophies were still in the year 1535 in the original place intended, which also accords with a representation on a coin of Alexanmer Severus. Maas and Lanciani then mean that no nympheum could be here at all, and

that the structure of Alexander Severus was merely restored; "The water facade near Gate Maggiore is also a monument of victory. The triumphal chariot appearing to exist on coins as the uppermost ending of the monument and the trophies in the side niches leave no doubt concerning the purpose of the building. A purely ornamental design is not to be conceived, - - -, thus the monument of Gate Maggiore, the twofold problem of being an ornamental fountain and at the same time a triumphal monmuent -- a Fountain of Victory -- indeed for Domitian.(88 - 89 A.D)" (Fig. 543).

Note 361. Maas. p. 64, 65).

367. Nympheums.

As a nympheum in the preceding sense should be considered a structure in Rome, the so-called "Minerva Medica", whose decagonal domed structure with niches was mentioned in Art. 231 and Figs. 339, 341. The so-called Palatine Stadium with its massive vaulted exedra (span of the niche vault is about 85.3 ft.) now passes for a formerly magnificent palace garden design with a nympheum, when that in Palace Flavian (House of Augustus) should not be forgotten.

368. Spring Fountains.

A monumental and artistic treatment was also given to the public ornamental fountains, scanty remains of which exist for us in the so-called "Meta Sudans" at Rome, or in English, the "dripping terminal column", from the apex of which gushed the water, falling into the circular collecting basin. The crumbled masonry of the nucleus in the form of a sugar loaf still gives some data for the for the proportions of the dimensions of the work, but it is not sufficient or even determinative for the original form.

The motive of the Meta Sudans may have been repeated at a smaller scale at other places, and we scarcely err if we derive our general conclusions for the general form from the smaller pieces in marble,[362], an example of which is given in Fig. 544.[362] In the Museum at Aquileia exist three similar examples made of white marble, one of which has the form of an exedra, the other expressing the same idea as in Fig. 544, excepting that shells and masks here alternate in the semicircular niches, while the water fell in the same way upon the

steps and into a great square basin. The water flowed from small openings in the shells; but also from the apex, judging from the cap, a great jet must have sprung upward and have overflowed the whole in its fall. If we crown the apex with a bronze pine cone in the manner in which it stands in the court of Bramante in the Vatican (Fig. 545) and permit the jets of water to fall from it as at the fountains on the Place of S. Peter; if we further add a neverfailing ornamentation of figures (the Nile in Bracchio Nuevo and the Marforio were formerly fountain statues) -- then might the representation in Fig. 546 be indeed accepted as an ornamental fountain of the imperial period. Concerning the fountain (cantharus) of Old S. Peter's and the antique "pignen"[364] fountains, see the treatise by Hülsen mentioned below.

Note 362. Reproduced from Annali dell' Istituto di Corres. Archaeol. 1867. Plate K.

Note 363. Jordan, H. Sulla Forma di alcune Fontane a Roma. Annali dell' Istituto di Corres. Archaeol. 1862. p. 398, m. Plate d'agg. K. 2 - 7.

Note 364. Rome 1903.

Small and charming examples in private houses at Pompeii can be found in still handsome models (Compare House of Apollo, House of Vettii, House of Lucretius, fountain figures of bronze in Museum Nazionale at Naples, House of Centenario, animals spouting water (like boars, dogs, lions, does, serpents, etc.), bronze pine cones with arrangements for water jets in Avendos and Pompeii).

369. Street Fountains.

Besides these ornamental fountains occur the street fountains, which served for daily uses of all persons and were mostly placed at intersections of streets. These were works of the simplest kind -- rectangular troughs made of lava slabs and a pillar with reliefs, from which the water flowed.[365]

Note 365. Compare Mau, A. Pompeii in Leben und Kunst. Leipzig. 1890.

370. Sewers; Cloaca Maxima.

A regular removal of foul water was already cared for in the best manner in the Etruscan cities.(Marzabotto). Rome is in no respect inferior, as the splendid example of the Cloaca

Maxima there shows. Open watercourses must indeed have been first utilized for the removal of sewage; their banks were later walled and then covered on account of the bad odor. Merckel[366] may well hold, that the entire plan of the Cloaca so strongly represents a watercourse in the Campagna, it is very probable that we have to see in the Cloaca Maxima a canalized stream, which ended in the Maranna near S. Giorgio in Velabro, the banks of which were first walled and the course was then vaulted. It was designed to collect the water flowing from the Quirinal, Viminal, Esquiline, Caelian, Palatine and Capitol hills toward the Forum Roman, and to lead it to the Tiber.(Fig. 547, from the drawings of Narducci, published[367] in 1888 by Otto Richter and Paul Graf). With reference to the technical construction, it may be stated that all original parts were executed with ashlars of Gabine stone, 8.20 ft. long, 2.63 ft. high and 3.28 ft. wide, without the use of mortar. The corresponding walls are laid up with 3 to 5 courses of ashlars; the semicircular tunnel vault is composed of 7 to 9 carefully dressed voussoirs. (Fig. 548). The width of the channel increases with the increased volume of water toward the mouth at the Tiber.(Fig. 547). According to tradition, this sewer was arranged by the Tarquins; later investigations led to a different result. Hülsen states in the publication mentioned below:--[368] "I may here only mention the branched network of sewers, partly of a very ancient period, which extends beneath the Basilica (Aemilia). Their height proves -- what resulted from the excavation of the street before the Basilica, especially that the Cloaca Maxima as heretofore known represents a rebuilding in the early imperial period, about that of Agrippa, but it must not in any way be considered as a monument of the first centuries of the city." And the same author further states,[369] that the recent excavations have likewise furnished most interesting data for the history of the Cloaca Maxima:-- "At the southwest angle of Basilica Aemilia, where a large portion of its vault is laid bare, it appears that the structure represented by Narducci plainly lies higher than the level of the republic. The side walls partly rest on an ancient street pavement of large tufa blocks; the crown of the vault lies at the height of the foundations of the imperial basilica,

about 4.93 ft. higher than the plane of the republican Comitium and of the Lapis Niger." And according to the further astonishing discoveries on the Forum Roman (compare Fig. 236 and Note 115), Hülsen further makes known; that finally by these is again justified the Roman tradition, by which the Cloaca Maxima is to be ascribed "to the powerful dynasty of the Tarquins, immigrants from Etruria, and especially to the last kings.[370]"

Note 366. Merckel. p. 455.

Note 367. In Antique Baudenkmäler, published by Kais. Deutsch Arch. Inst. vol. 1. pl. 37. Berlin. 1891.

Note 368. Hülsen, Ch. Die Ausgrabungen auf dem Forum Romanum 1898. 1902. Mitt. d. Kais. Deutsch Arch. Inst. Röm. Abta vol. 17. Heft 1. p 42-44. Rome. 1902.

Note 369. The same. p. 57.

Note 370. Compare Neue Jahrbücher für das classische Altertum. etc. 1904. Abt. 1. vol. 13. heft 1. p. 28-29. Leipzig.

Sewers designed in a technically more perfect manner are shown in very many ancient cities. Besides those in Rome and Pompeii, for example, in Arpino, Parma, Aosta, Verona, Nimes, Arles, Vienne, Lyons, Besancon, Perigueux, Metz, Rheims, etc. Many of these sewers constructed by Roman engineers, their roads and numerous creations in the domain of water supply, of bridge-building and of harbor construction, are still in use and may well be compared with similar modern works, especially when the duration of their employment is taken into consideration.

The ancient capital of Bithynia -- Nicodemia -- can likewise still exhibit the remains of a great sewer design, the outlets of which extend to the sea and transport their contents there. The subterranean branch sewers of the city end in larger collecting sewers, whose outer walls are next the sea and were built as strong walls with buttresses. Narrow round-arched slots in them permit the emission of the sewage into the sea.[371]

Note 371. Compare Daremberg & Saglio. p. 1264.

371. Public Privies.

Into the sewers was also conducted the sewage from public and also frequently from private privies. At the northwest

angle of the Forum in Pompeei, the pipes for supplying the privy there with water and for removal of the sewage may yet be recognized. A second arrangement of greater extent appears near the Stabian Baths. The neighboring Puteoli (now Pozzuoli) can also show the ancient Macellum, its market for vegetables and fish (the so-called Temple Serapis), two such there, one of which was drawn and published by de Jorio. At one end of the building were tw large rectangular rooms, intended for privies, whose external walls were internally surrounded by great stone benches with circular openings at different points, before which ran a deep open gutter. The belief that one had to do with a temple structure here afforded opportunity for the assumption, that "thermal vapors" ascended through the seat holes of the stone benches -- a belief overthrown by the discoveries in Pompeii and especially by those in Timgad (Africa). The mysterious chambers of the Temple of Puteoli became only prosaic privies! In Timgad (compare Figs. 549, 692), 25 marble seats were arranged in one room, which was separated in pairs by marble arms in the form of dolphins. Small openings are cut in the stone front at each seat, through which lead shallow open channels into a larger collecting gutter beneath the seat; they were intended to conduct any spilled water into the gutter mentioned. A second open channel extended before them along the row of seats. The space between was covered by great stone slabs. The arrangement for constantly running water for cleansing was foreseen, and the whole thus forms a city sanitary arrangement of the first rank, which is superior to many of our own in the 20 th century, even in large squares.

The excavations on Crete have shown allied arrangements in the palaces in complete form, even 1400 years B. C.! We therefore need not be especially proud of our attainments in this domain.

Chapter 15. City Dwellings.

"But men easily forget, that between the Homeric poems and the building ordinance of the emperor Zeno lies the development of 12 centuries, during which words and things have changed in importance. Men forget that house architecture depends upon the actual civilization of the time; for it will vary in differens cities and will be different in a fortress than in an open market town. And men forget lastly, that both the plan and the arrangement of a house results from the material and the method of construction. Anciently, each man was his own architect, and he brought from the forest as many logs as he needed; the log cabin was succeeded by the stone structure, until the use of lime mortar and the development of manual skill afforder the scope for architecture, by which the height of civilization is characterized. ---"

Nissen, H. Pompeianische Studien etc. p. 594. Leipzig, 1877.

372. Origin.

With the foregoing presumptions, the schemes for Roman house and palace architecture derived from scattered statements in literature possess only conditional value.

The Etruscans created the model of the house of the Roman citizen, both that with a closed roof and the great entrance doorway as the sole admission of light and air to the interior, as well as that provided with the opening in the roof, in which it was more comfortable and cosy to dwell, and thus also made possible an artistic treatment of the interior.(Fig. 550). For the poor and the inferior peasants, the former sufficed in all ages, in the form of a miserable hut -- the capanna, as it has been preserved to us in the clay urns in form of houses.

The South required from the house for its occupants protection from the sun's rays, the possibility of cool and airy life in a room open above and that of enjoyment within the solid and windowless walls and not, as in the North, the tepid warmth of a room closed on all sides with a fixed ceiling and complete roof with light introduced at the sides through windows, by which air and light were admitted in good and bad weather. The Etruscan model of a dwelling with the opening in the roof, which may be designated as national, was retained until about

the end of the republic and even the beginning of the empire, until the acquaintance of the Romans with Grecian culture and art produced likewise an innovation in the art of living. The Grecian house was normally developed; the Roman of the imperial period was composed of that designated as national and of portions of the Grecian. Both kinds -- the national Roman and the Grecian-Roman house -- still remained in use together, until the latter entirely supplanted the older form. For the residences and palaces of the great, the Hellenic form of plan won supremacy everywhere.

373. Peasant's House.

The peasant's house, or rather the shepherd's house (capanna) certainly preceded the city dwelling, and from it was developed the latter in time and by additions. Cabin and additions, indeed originally carelessly joined without union, were firmly combined into a whole by a common roof. We cannot and need not directly deduce the one from the other, or see one in the other. How the change was completed in time, we may indeed set right and conceive; but the attempt to determine every single step in the forward progress will best be omitted here. Such matters will ever remain more or less intellectual hypotheses, all of which do not lack an internal probability. Nissen [372] (see his work) thus recognizes in the plan of the peasant's house in lower Saxony that of the ancient Italian, or here again that of the national Roman house, while Patroni [373] says, that a "comfortable house" for the South could not have been brought from the interior of Europe, but only across the Mediterranean from the East to Italy; that the actual house in the Roman plan was the tablinum (Fig. 550), which opens like the megaron, and to which the atrium was merely a court! That in the latter the smoke and foul air (Atrium ex fumo) escaped through the compluvium. That the tablinum was not a later addition but was rather the central point, to which all else was attached, and in the Grecian-Roman house never existed an "atrium testidunatum", which he would have gladly believed, and that the Corinthian atrium was the oldest form, even on account of the construction. On the other hand, it may be objected, that for moderate dimensions of interiors -- and the transition from the small to the

great must be accepted as certain -- horizontal beams received the construction of the ceiling and roof before vertical supports were introduced, and which first became necessary with great dimensions of rooms.

More assured starting points for the treatment of the plan of the Roman dwelling only resulted from the excavations in Pompeii, systematically prosecuted since 1748, and these represent the houses there, with few exceptions (for example, the House of Sallust and House of the Surgeon), as belonging to the Grecian-Italic type. They are imitations of the houses of the nobles of other lands and are not extensions of the Italian peasant's house. The combination of the ancient Italian with the Grecian house plan is completed; to the Tuscan atrium has been added the Grecian peristyle.

But the conditions in imperial Rome were somewhat different. The dwelling in a single story was henceforth a privilege of the great alone; it ceased on account of the rapid increase of the population; in the great city, men were compelled to resort to buildings in stories, in order to provide accommodation for all the people, that gathered there.

Note 373. In the Origine del Domus. Rome. 1902.

The merchants carried on their business and lived in booths of boards (tabernae), or as in Pompeii, the shops lying next the street on a level with a private house within, with which were rented storerooms, work shops and living room in an attic above them. The contented citizen dwelt in his own little house; the rich lived in their stately mansions and villas, the prince in his palace, but the poor people occupied the booths (tabernae), workshops (pergulae) and attics (cenacula) -- and the blocks (insulae). These were chiefly grouped around a long court and they were divided into 3 or 4 stories at the time of the downfall of the republic.[374]

Note 374. Compare Attilio dei Marchi. Ricerche intorno alle "insulae" o case a pigione di Roma antica. Milan. 1891.

374. Rented House.

Hülsen makes the following statement.[375] The Roman house for rental (Fig. 551) comprised in its different parts the rentable rooms in the upper stories (cenacula), the stairs (scalae), usually opening freely from the exterior, the partly open nar-

narrow passages between the blocks (insulae), admitting light and air sparingly to them, which were mostly without an inner court (angiportus). windows and doors, smoke chimneys, privies and sewers; projecting balconies and flat roofs (maeniana and solaria). The picture of these house blocks drawn by dei Marchi is indeed not at all attractive; bare and plain facades of the houses, not even covered by plastering, blackened by smoke escaping from the different openings; dark booths in the ground story, windows arranged without symmetry; here and there a window sill covered with flower pots, projecting balconies and wooden gutters for the roofs; the roof surfaces unbroken by chimneys, but rather arranged in terraces and decks; in the interior being narrow and steep wooden stairs with bad light and ventilation. -- Hülsen [376] here adds:-- "For realizing the internal architecture of Rome in the imperial period, there is perhaps no better modern illustration than that of the old quarters of Naples with their narrow streets and alleys, the "sopportici" and "fondaci". The Neapolitan family of the lower class, that lives in a single large rectangular room on the ground floor, that has a wide doorway next the street and contains in the interior sleeping places, kitchen and work room, separated only by low wooden partitions; it lives under conditions, which are probably very similar to those of the ordinary people (plebs) of Rome in the imperial period."

375. Compare the Jahresb. über neue Funde und Forschungen zur Topographie der Stadt Rom. 1891. p. 281. Rome. 1892.

Note 376. The same. p. 282.

And still another parallel may be drawn.

In the ground story of the palace of the present Roman, or more generally of the Italian nobility, are arranged shops and offices, that have no connection whatever with the rest of the house; the like is found in Pompeii, and it could not have been otherwise in ancient Rome.

In accordance with the development mentioned, the parts appertaining to the ancient Italian house also bear Roman names;-- atrium, fauces, ala, tablinum. those taken from the Grecian retained their Greek names:-- peristylium, triclinium, oecus, exedra.

395. Vitruvius distinguishes between five kinds of atriums; the Tuscan, the tetrastyle, the Corinthian, the displuviatum and the testudinatum. It is said of the latter, that it indeed never existed in any city house architecture. Concerning the next to the last, Mau states 377 (p. 235) that Pompeii does not present an assured example of it.

But the atrium "testudinatum" was at the same time also the "displuviatum", i.e., the rain water was conducted away, and which was required by the isolated position of the house; for a free passage of 2 1/2 ft. in width to receive the flowing water was required for houses with hip roofs by the laws of the 12 tables.

Indeed after the burning by the Gauls, as we see in Pompeii, house was built against house in Rome, which made necessary the atrium compluviatum, by which the rain water was conducted into the interior, and it was collected in a cistern, before drains came into use.

To the compluviatum, the opening in the roof, corresponded the impluvium in the floor, i.e., an excavation of the size of the opening mentioned, in which was collected the water that fell from the drip tiles or was caught in box gutters and led to the ground through water spouts, from which it was led to the well (puteus).

According to the construction was distinguished the Tuscan, the tetrastyle, and the Corinthian atriums. In the first, the plates or eaves of the roof rested on two transverse beams (girders), while in the latter the eaves were supported by four or more columns; they might also be raised and form the ridge of the shed roof, if the tetrastyle or Corinthian atrium was at the same time displuviatum.

The light entering the interior abundantly through the compluvium permitted a better utilization and a better lighting of the inner rooms, making light openings toward the street unnecessary.

The entrance doorway might be reduced in its clear dimensions, since it no longer served to admit light; but it yet always remained large and stately, in memory of its formerly two-fold purpose.

376. Vestibule, Passage, House Diorway.

The way to the atrium from the exterior led through the vestibule, a passage in the house and opening toward the street, but which, however, did not exist in all houses in Pompeii. The name is derived from "ve-stare".(I.e., to stand aside).

The inner passage between the door and the atrium was termed "fauces" or "prothyron". The entrance doorway was enclosed by a sill and side posts with an upper plate or lintel.

377. Tablinum.

The tablinum occupied almost the entire width of the rear side of the atrium, opening toward the former and into the garden or peristyle. The larger opening could be closed by a portiere, the smaller one next the garden might be closed by folding doors.

The tablinum formed the commencing point of the plan with its two subordinate apartments (Fig. 550), the atrium and its adjoining cells being but a forecourt, as Patroni will have it. "Tablinum" is properly a wooden arbor in which men eat in summer.

378. Alae.(Wings).

The rooms opening on both sides, right and left before the tablinum, were termed wings (alae). Data are wanting in regard to their purpose and use. They were indeed an enrichment of the atrium; men also sometimes ate in them, and Vitruvius places there the images of the ancestors.

From the wings outwards were generally accessible two large apartments lying on the right and left of the tablinum, of the same depth as it, and which must likewise have served as dining rooms.

379. Andron. (Men's Room).

In many houses, a narrow passage between the atrium and one apartment led from the atrium to the peristyle -- called andron, and which was closed by doors at each end.[378]

Note 378. Compare Mau. p. 243.

380. Rooms around Atrium.

The rooms lying next the street, which were crossed by the vestibule (fauces), were chiefly arranged for shops, and they were either occupied by the owner of the house himself, or in most cases were rented to merchants or even utilized for the

housekeeping. The two or three small cells behind these and on each side of the atrium were arranged as sleeping rooms.

381. Court and Peristyle.

The ancient city houses had no courts; yet later was added the peristyle as an extension of the house plan, the garden enclosed by covered porticos and its subordinate buildings, such as storerooms, kitchen and hearth. A table (curtibulum) occupied the place of the hearth in the atrium.

382. Buildings in Stories.

These enlargements of the ground plan were followed by those in height; the house designed for one story received another, whose rooms were termed cenacula and only had windows or openings for light closed by shutters. These were either occupied by the owner or rented.

Inconvenient and architecturally unimportant stairs led up to them. The greater number of such stairs in a house must compensate for their lack of convenience.

Toward the end of the republic, the lack of space in the interior of the city of Rome compelled the erection of buildings in stories, as previously stated. Both houses for rental and dwellings for families were built in several stories. Under Augustus, 70 ft. was fixed as the maximum height of these, and this was reduced to 60 ft. by Trajan.

Complaints of dear rents and bad construction of the houses for rental, designed to produce the greatest possible rental, are to be found everywhere. The occupants of the upper stories found themselves continually in danger, since by overcrowding, the foundations began to fail, and therefore the fall of the building is frequently mentioned, as often as its destruction by fire. There were 44,000 of such rented barracks, closely packed together and only separated by narrow and crooked alleys, in comparison with 1780 houses of the nobles.

We can distinguish between three kinds of dwellings in ancient Rome, exactly as in our modern great cities:--

1. Those consisting of shops (tabernae) and workshops with a room in the upper story.

2. The rented dwellings for single persons and for families in the upper stories (cenacula) -- frequently with separate entrances from the street and stairways.

3. The dwellings for families or nobles.

The story on the level of the ground always continued to be preferred, the dwelling of but one story was esteemed more dignified. But with the increase of the needs and the claims of life, men could not utilize the simple enlargement of the house in space; a luxury in the furnishing and arrangement of the house in time appeared, especially among the notables, that increased inconceivably and attained its highest point under Nero. In these richer houses were then added still other rooms; such as picture galleries (pinacotheca), rooms for sports (sphaeristerium), the large salons (oeci) adorned by columns and galleries, open rooms for conversation (exedrae), gardens with nymphea (waterworks), rooms for the installation of house altars with the statues of the house gods (lararium) or small chapels (sacellum, sacrarium), and a bakehouse with mills (pistrinum) in the housekeeping portion, etc. Cellars (hypogea) were exceptional; they are rare, at least in Pompeii.

383. Citizen's House of medium size.

A clear illustration of the subdivision of a citizen's dwelling of medium size is given by the so-called House of the Figure Capitals in Fig. 552, and that of a very small one in Fig. 553, 9.

The floor of the ground story is higher than the sidewalk by two steps placed outside the door. The door is not directly on the street, but is somewhat recessed, thus leaving a small lobby (vestibule), in which those entering could await the opening of the door, while protected from weather and from the crowd on the street. This lobby is a reminiscence of those great vestibules of the houses of the notables, that would be useless on the dwelling of an ordinary citizen, and with the decay of the institution of the clientele would generally have no further purpose. The entrance is architecturally of imposing form; pilasters with rich capitals and mouldings surround it; paintings, good wishes, the name of the owner, "a symbolical ornamentation by power averting misfortune" adorns the walls; the sill bears the greeting "salve" (welcome) for those entering.

Generally wooden doors with two or more leaves swing inward and lead into a hall in which lay the house dog chained. But instead we find also the same merely represented -- in mosaic

on the floor or painted on the wall -- with the warning inscription "beware of the dog (cave canem). At the door also remains the doorkeeper (ostiarus, janitor), who has his own separate cell adjoining it, which is furnished with a small and narrow window next the street. The hall is closed from the atrium by a portiere and it contains (in most houses still in the 4 th century A.D.) behind the house door the deity protecting the house (lar, tutela); the gods (lares) in time receive their own chapel (sacrarium) in the interior of the house.

The atrium occupies about a third part of the area of the house (exclusive of the peristyle) and is without columns, as for the Tuscan; its impluvium is small in proportion to the entire floor area of the atrium. It consists of a rectangular basin enclosed by moulded stones, and which is little smaller than the former compluvium, channels and pipes for removing rain and foul water extend beneath it; openings in the floor permit their escape. A marble table stands at the end, the money chest is at the rear in the tablinum. The atrium is protected from the sun's rays by stretching an awning over the compluvium. Into the atrium open five smaller and two larger rooms, which serve as living and sleeping rooms; all could be closed by wooden doors, judging from the arrangements in the floor, -- a method of closing rooms that was not generally common. Portieres of cloth sufficed for closing the apartments in most cases. One of the small rooms contains a well and the stairs. Entirely open towards the atrium are the alae and the tablinum, the latter being the proper centre of the house, and which serves the master as a business office. This is usually separated from the atrium by a curtain, while it has a board partition with a door next the peristyle, like the two large rooms opening into it, as shown by the arrangements still remaining on the floor

Between the tablinum and the room , a passage that could be closed by doors, forms the connection between the atrium and peristyle. The walls of all rooms mentioned are covered by paintings, the rooms themselves being furnished with house utensils, ornamental and art objects, costly fabrics and sculptures, statues, vases, candelabras, suspended marble medallions, etc. The alae receive a special decoration by the ancestral figures (imagines); these were originally portrait masks

of wax for exhibition (waxen death masks), and at the funeral ceremonies, casts were made from them and wrought into busts and placed on the walls in little shrines like temples; inscriptions beneath them make known the name and deeds of the person represented. For those newly risen or house owners without ancestors, the figures of the emperors or of other distinguished men must replace the ancestral figures.(Imagines).

Behind the atrium or tablinum extends the peristyle, that in the given case, in order to secure wide and usable passages, is only surrounded by these on three sides. The placing of half columns along the partition wall must atone for the lack of the fourth passage, or complete the architectural form as well as possible.

384. Larger Dwelling.

The ground plan received a later extension, when beyond the peristyle were arranged halls (oeci) with colonnades and an open garden (compare that of Pansa in Pompeii), or a second and larger peristyle. In the latter case, the first peristyle was surrounded by social rooms and the second by rooms for housekeeping and for slaves. An enlargement upwards ocurred by the erection of an upper story, that entirely or partly enclosed the hall and peristyle, had windows internally and externally and was built for living and dining rooms, for places for recreation, open or partly open.

385. Shops.

If shops were combined with the house in order to make it more rentable, these opened on the street and were only connected with the interior of the house, if the owner of the house was at the same time the dealer in the shop. They were otherwise separate from the interior and only accessible from the street. the renter closed the shop front at night by a wooden shutter furnished with a door, that could also be closed in winter or during rain.(Fig. 533, II).

386. Location and Dimensions of Rooms.

Vitruvius (Book 6, 1-4) then requires in addition to the usual arrangement of the rooms a regard for the points of the compass for the location of certain rooms, but which in most cases must remain an empty desire, owing to the peculiarities or irregularities in the plan of the city, and also could

scarcely be made possible in the typical ground plan. His rules, like his house plan, must only refer to the enlarged and isolated house of a patrician, since rooms are introduced by him, that do not occur in the ordinary houses, and not much regard seems to be paid to the extensive claims of the renter in utilizing the ground for building sites and in building thereon.

Sleeping rooms and library, as well as the spring and autumn dining rooms, Vitruvius requires to be placed on the East, the winter dining room and bath room being on the West or Southwest, so as to have the afternoon sun, but the summer dining room and picture gallery, as well as some kinds of workshops, like the ateliers of painters and weaving rooms on the North. On the whole, he would have the arrangement and the subdivision of the rooms arranged according to the climatic condition of a country. For the North, he recommends houses in blocks (not detached), or for the South open houses facing North.

The dimensions of the different rooms, according to Vitruvius, should stand in certain relations to each other. The rules given by him frequently harmonize with the buildings and correspond almost entirely to the proportions employed in good works.

387. Atrium and Side Rooms.

For the atrium, the breadth should be to the length as 2 to 3 or 3 to 5; otherwise the width requires to be the side of a square, whose diagonal gives the measure of the length. To this rule corresponds the atriums in the House of the Tragic Poet with 2 to 3, in that of Sallust with 2 to 3, and in the House of Pansa with 2 to 3.5.

The height of the same to the beams is made rather too small at one-fourth the length; but the depth of the side rooms at one-fourth to one-third the length of the atrium and a height equal to the width agrees everywhere.(compare the Houses of Tragic Poet, of Holconius, Rufus and of Sallust).

In the earlier attempts at restoration, the atriums are mostly made too low -- a conception that has no historical basis and is not appropriate to the architectural character. For this reason, Mau makes his atriums generally higher than the succeeding peristyle, while in opposition to Padroni, he assumes that the atrium does not represent the court, but rather

the great hall -- the chief apartment of the house. If the court be assumed as the basal idea for the atrium, very little is changed at first in the required height; it is thereby only more urgently demanded. The peristyle is a garden surrounded by porticos; these must afford protection from sun and rain and therefore must not be high, but they should fulfil their purpose.(Compare the longitudinal section through the House of the Silver Wedding in Fig. 556).

388. Tablinum.

The tablinum should be one-half, two-fifths or two-thirds as wide as the atrium, according to the dimensions of the latter, which must again be termed sufficient; further, the height to the underside of the beams is one-eigth more than the width, and for the height to the ceiling panels is yet to be added one-third of the width.

389. Peristyle.

Vitruvius requires for the peristyle a transverse position in reference to the main axis of the house, which, for example, is retained in the House of the Dioscurii and in that of the Great Mosaic, in that of the Faun and in the House of the Vettii (Fig. 557) and others at Pompeii, but which is just as frequently neglected in others; the longitudinal axis then coincides with the principal axis of the building.(For example, the House of Pansa). The columns are to be made as high as the depth of the portico, which, for example, agrees with the House of Centenario. The arrangement of the columns is aerostyle throughout.

390. Triclinium, Exedra and Picture Gallery.

For the dining room (triclinium), the length on the plan is required to be twice the width and the height to equal the sum of the length and breadth; further, the conversation rooms (exedras) or square hall should be made one and one-half times as high as one side; picture galleries should also be made of considerable size. Dining rooms in the upper story are assured by Mau's data from Pompeii.(Fig. 558).

391. Corinthian and Egyptian Halls.

The Corinthian hall was made equal in dimensions to the dining room or even larger; it had simple columns with and without plinths, and above the architrave and cornice rose a semicircu-

semicircular tunnel vault.

The Egyptian hall had a similarity to the basilica, according to Vitruvius, yet only with the difference, that the former had the passage externally (that the passage was open to the sky, compare the text of Vitruvius), and the latter had the passage internally. The design was 3-aisled in plan, and the middle aisle was raised in elevation. The clearstory wall was adorned by columns, penetrated by windows and supported a coffered ceiling; the half columns projecting from the wall were three-fourths as large as the lower columns of the hall. (Fig. 559 shows a hypostyle Egyptian hall).

392. Cyzenican Halls.

Vitruvius says that the Cyzicenean hall was no longer employed in Italy; it lay open at the north with a view of the green fields on which it opened. Two tables must be arranged opposite each other; they had windows at the ends extending down to the floor.

393. Facade.

The facade, the ornamental portion of a mediaeval or modern house standing on a traveled street, could play no part in the architecture of the ancient world, according to the mode of life described and the demands made on the house. In the "quiet" streets, it appeared as a whitewashed wall with a large doorway opening and some irregular window holes located by their purposes,(Fig. 555), finished with a slightly projecting rafter cornice, as the was on the House of the Vettii in Pompeii[380] -- and this belonged to a rich man of "no prominence!" On other larger dwellings, the entrance doorway was at most somewhat better treated with pilasters and the overlying architrave and cornice.(House of Rufus, House of the Figure Capitals, and others). On facades lying on traffic streets, the openings in the shops could be closed with boards, were added as an architectural motive, not exactly beautiful in effect.[381] A projecting story on the street facade is exhibited by the House of the Hanging Balcony.(Fig. 560).

Note 380. The House of the Vettii is both worthy of consideration and very instructive for the later period, splendidly ornamented, especially by beautiful paintings. Fig. 561 gives a view of the present condition of the interior of the house,

excavated in 1894-5; for the splendid paintings, see the publication:-- Pasquale d'Amalio & Sogliano. Nuovi Scavi di Pompeii. Casa dei Vettii. Naples. n.d.

Note 381. Compare Mau. p. 141.

394. Interior Decoration.

"The conception of antique buildings is only perfected when the colored ornamentation is added."[382] The structural parts of the house, columns, entablatures, pediment, and likewise the space enclosing walls and ceilings were painted in strong colors, just as the floors shone with the decoration of variegated marbles and richly colored fabrics, stretched before the doorways and between the columns of the peristyle or lying on the floor, heightened the color splendor of the entire interior. The deep blue sky, the shining rays of the sun falling through the compluvium, the reflecting water of a fountain, a bed of variously colored flowers, men adorned by colored and rich garments, charming views and perspectives, with effects of lighting in the different rooms permit the southern house, isolated from noise of the streets and dust, to appear with a charm, which must forever remain foreign to the northern dwelling, in spite of glass windows and roofs, winter gardens and central heating. The graceful mode of ornamentation in stucco and painting could only occur and exist in the blessed southern climate; it could only thus be developed in an architectural style without windows; "it required the entire wall for its extent and little house furniture."

Note 382. Compare Burckhardt. p. 57.

Just as little as in the great monumental architecture were the Romans original in the ornamentation; they likewise here entered into the Greco-Oriental inheritance, which they plundered in their fashion and extended. They sometimes reverted back to long forgotten methods and revived primitive processes. Thus the stereography already in vogue in the later period of Grecian art was again taken up in the Augustan period, and it was afterwards again supplanted by the primitive barbaric procedure of veneering with slabs of variegated marbles.

Vitruvius (Book 7, 5) mentions three kinds of decoration in chronological order. According to this, the ancients (Greeks ?), who introduced mural decoration, imitated at first the marble

veneering slabs, then the cornices and the variously colored and alternating ochre yellow and vermilion red panels; the later represented buildings and columns as well as high pediments, landscapes, grouped figures etc., and now (in the time of Vitruvius) men make frightfully distorted forms; instead of columns are reed stems, in the place of pediments are recurved ornaments, candelabras as the supports of temples, etc., as mural decorations. "Sense clouded by a diseased tendency of taste" no longer understands how to distinguish the correct from the capricious.

Semper[383] justly accepts this sequence only in case Vitruvius goes back to the heroic period (marble incrustations at Mycenae) with his first kind. This method of incrustation was again completely lost during the Hellenic art period; it had to give place to the scenography of Polygnotus and Agatarch, and after a long time of disuse, it was by Asiatic influence again taken up in the Hellenic period, when it again supplanted that scenography. From the Greeks of the Alexandrine period, the Roman borrowed this method and the decorative principle[384] produced by its imitation with colored stucco panels.

Note 383. In Der Styl. Vol. 1. p. 492. Frankfurt-a-M. 1860.

Note 384. Compare the same. Plate 15. Wall from the House of Sallust.

Under Alexandrine-Egyptian influence likewise originated the luxuriant mural painting with the fanciful architecture and its slender reed columns, canopies, with pediments crowned by sphynxes and griffins.

Note 385. Compare the same. Plate 14.

The ancient mural painting and the polylithic wall covering were of about the same time, or the one was shortly after the other mode; the latter supplanted plastering on the wall and the mural painting connected therewith almost entirely also, or compelled this to pass into mosaic painting, in order to[386] assimilate it to the incrustation with red marble.

Note 386. Compare the same. p. 495.

The revival of the method of marble incrustation, said by Vitruvius to be the oldest, first began to be common in the time of Augustus, wherefore he indeed assigns to it no further estimation. We have something more definite from Seneca;

"Every one now believes himself poorly and miserably housed, if his walls do not shine with great and costly marble panels." Pliny speaks further and laments the decay of painting, which was supplanted by marble incrustation.(Compare the statements concerning the House of the orator Crassus, the House of Mamurra, the House of Catullus, the stage of the Theatre of Scaurus, etc.).

A kind of mosaic in hard stones, in the nobler stones inlaid in marble, which represented various objects and animals, was introduced under the emperor Claudius; under Nero were to be seen marble tables with artificial veins and spots, for example, Numidian marble with purple veins, etc.

Of the various methods of ornamentation mentioned, very important examples have been preserved for us in Pompeii, Herculaneum, Rome and other cities, and since Pompeii was built in a day just as little as Rome, we thus find together in this single city nearly all the methods of decoration mentioned by Vitruvius and critically examined and compared by Semper, what has indeed struck every artistic or technically informed visitor of the city since 1748, and has become evident; ""There result thorough diversities in which are prominent the earlier and the later." Therefore we cannot speak of a single Roman period; as for architectural forms, we must distinguish between the periods in which one or the other was common, and whose characteristics and general art values are examined; for the ornamentation by colored plaster ashlars on the wall and the veneering it with marble are equally Roman in a certain sense, as the grotesque painting and the scenography.[387]

387. Overbeck & Mau, (Pompeii etc. 4 th edit. Leipzig,1884) in accordance with their investigations of the Pompeian mural decorations, firmly adhere to Vitruvius' sequences in age, when they make the earliest mode of decoration consist of a stucco relief imitation of the covering with marble slabs of different colors, and which they designate as; 1, the incrustation or architectural relief style, succeeded by ; 2. the painted architectural; 3. the painted ornamental; 4. a strictly painting style. The correctness of the generally accepted statements of Vitruvius and Pliny is proved for Pompeii by these results. Also compare Mau, A. Geschichte der decorativen

Wandmalerei in Pompeii. I, II and III styles. Berlin. 1882.

The pattern of ashlar incrustations and these imitations in plaster and painting as mural decorations arouse but a limited interest, a greater one concerns the freely designed, fanciful painted architectural representations with their pictures, their plant and grotesque ornaments.

Burckhardt[388] (p. 60) allows to the ancients, that they did not imitate any actual architecture by their deceptive perspectives, that had only a poor effect in comparison with the real -- a view that one can gladly accept, in spite of the sketches of the learned mathematician of Tralles and of the Philippica of Vitruvius.

A general arrangement, a certain system in the decoration is then peculiar to all this painted mural decoration, whether it belongs to the earlier or later time, or the hand of a Grecian or Roman painter may be recognized thereon, i.e., the triple division of the wall in height and its subdivision into panels, which are definitely continued through all three zones.[389]

Note 389. Compare Jones, O. Grammar of Ornament. Chapter V. Pompeian Ornament. London. 1856.

Likewise may be recognized a gradation of the colors in the better works, where the lowest zone or dado is generally darkest (black), the second or wall zone is lighter (reddish brown, yellow, red or blue), and the third zone or frieze is made the lightest (white). This rule certainly does not invariably fit, since yellow dados, deep red, white or black wall panels and black friezes do indeed occur.

395. Plinth.

The height of the plinth or dado averages 1/6 th of the height of the wall; on earlier works it is architecturally subdivided by painted mouldings and projections (compare the wall of the[390] central hall in the so-called House of Livia on the Palatine and the wall with the Education of Bacchus among the recent finds in the Museum Tiber in Rome), while in most Pompeian houses it is treated as a surface, which was divided in parts according with the subdivision of the principal wall surface.

Note 390. Reber, F. Die Ruinen Roms und der Campagna. p.384. 2 nd edit. 1878.

396. Wall Surface.

The main surface of the wall is usually divided into three equal or unequal parts in height, the middle one of these being frequently emphasized architecturally, often as a shrine. In this opens a frame covered by a segmental arch, through which may be seen a large picture of a figure, that entirely fills it (compare the Education of Bacchus in Museum Tiber and House of Livia in Rome); or a small square mythological picture is placed in the centre of the panel (numerous houses in Pompeii). Smaller square and oblong pictures or even merely medallions with little cupids or heads ornament the side panels, which are framed more or less richly. The frame of the central panel in the good period consists of boldly treated and well profiled architectural members; columns, architrave, frieze and cornice are in forms entirely emancipated from those furnished by stone architecture, but they are still possible, and only the pediment-like additions vary from the severer treatment. The execution is there extremely tender and careful, as the remains in the imperial palaces etc., in Rome exhibit.

The later period bears the stamp of a more luxuriant treatment, but it deviates from the firm drawing and more quiet mode of composition and permits itself to run into degenerations, that frequently touch the Barocco; Pompeii exhibits much of just this kind. But men were least fortunate, when the entire architecture and some portions of the ornamentation there were replaced by white plaster.

397. Frieze and Cornice.

This strong division was omitted in the frieze; fancy unfolded its rich play there; grotesques, garlands, fabulous architecture, forms of men and of animals gayly alternate with each other, mostly painted in colors on a light ground, as if rising against the open air.

Particularly attractive and dignified appear the rooms, in which the walls have yellow dados and otherwise entirely white flatted wall surfaces, from which are detached the golden yellow architecture and the figures and medallions in color, an example of which is given on the adjacent colored plate.

The cornices are finely membered throughout and are decorated by relief ornaments and color in Pompeii.

398. Ceiling.

Little has remained of the ceilings in the houses, but more of such in public buildings and tombs. In the Villa of Diomede at Pompeii, the vaults of the lower rooms are decorated by a continuation of the sculptures of the walls on a light ground; in the imperial palaces of Rome, in the Villa Gordian (Tor de Schiavi), in the Baths of Rome and of Pompeii, in the tombs outside the gates of Rome, etc., chiefly occur ceilings with stucco reliefs in combination with painting. What appears blameworthy on the walls attains to an extraordinarily beautiful effect on the ceilings; it is just the combination of stucco and painting there, which makes the decoration so vivid and peculiar. Ornaments and figures in relief are certainly executed with the same freedom and boldness as the painted and as if dashed off rapidly. Everything appears to be made with a free hand, only the frames with their conventional ornaments, such as egg-and-dart or beaded astragal mouldings, are moulded. With the most charming of this kind belong the white stuccos in Museum Nazionale at Rome, that were found during the embanking of the Tiber; likewise the well known white stuccos of a tomb on Via Latina and of a circular structure near Tor de Schiavi. Splendid are the vaulted stucco ceilings of the Pompeian Baths. We give in the plate adjoining page 418 a portion of one such, that most beautifully shows the combination of stucco and color. Only blue, reddish brown and very quiet green are employed in addition to the white stucco, and yet what a charming effect is produced by the extremely happy treatment of the colors!

Not everything said of the diversity in arrangement and execution is against the system or period; much indeed depends on the sense and taste of the owner and of the painter, as well as upon the means at command. Whoever cannot pay for t the fancifully rich architecture on the walls with its views and figures must content himself with simple panels separated by bands.

Since the sma idea in the ground plan was varied in the most diverse ways, thus we behold in the ornamentation the leading motive transformed in a hundred ways, without either one losing sight of the original motive.

Finally is the remark, that the colors are mostly applied in full and unsoftened tones on accout of the borrowed lighting, as betrayed by the freshly uncovered paintings. They have all now become flat by the effect of weathering; they have partly faded or been entirely changed by the access of air since their discovery.[391]

Note 391. The author was in May of 1866 a witness how the fiery vermilion red ground of a frieze 5.3 inches wide, ornamented by yellow grotesques, changed within a few days after the uncovering into a perfectly pure black.

Furthermore, we find the transformation of colors on many Renaissance decorations in Italy, for example, where blue by access of dampness readily changes into apple green. (Compare Raphael's Loggias and Villa Madama).

399. Final Considerations.

"Air and sunshine were dearer to ancient men than to us; they loved neither the ascent of stairs nor the view of the streets, which is usually so much to us." In these simple principles of Burckhardt[392] is expressed the entire difference between a certain class of ancient and modern dwellings, particularly of the houses of families. We must not here fall into the errors of earlier writers, who treated all ancient dwellings as similar and did the same with modern. The house for renting with and without shops with us differs just as much from the family residence, as was the case in antiquity, and we must therefore only compare like with like.

Note 392. See Burckhardt. p. 53.

The antique man esteemed it to be more comfortable and dignified to dwell on the ground level in his house, particularly in the residence of the family, and he arranged his social, ceremonial and living rooms thereon, with sleeping and servants' rooms in a possible upper story, to which led unimportant stairways; the house life was shut off from the street and concentrated itself in the interior of the house, which caused the grouping of the living rooms around an inner airy court, from which they received light. This arrangement made unnecessary a subdivision of the outer wall of the house next the street and its perforation by windows. Living on the ground level, grouping the rooms about an airy internal court, no win-

windows toward the street -- these are the characteristics of the antique house of the family.(Fig. 552).

Opposed to this in the modern dwelling and produced by changed views of dignity and comfort in living, which already made themselves felt in the middle ages and in the Renaissance in Italy(Tuscan palaces), is the location of the dwelling in the upper story and the results thereby produced. Access to the principal rooms must correspond to them in design and ornamentation; the architecturally developed stairway must be introduced, which became the central point of the design of the house, like the tablinum or atrium for the antique house. The cavedium was changed into corridors and passages; the borrowed lighting, which the rooms received from the court through the portico was replaced by direct side light from the street.

The simple change in the height of the location of the principal occupied story further distinguishes the modern from the antique house; everything else that we are accustomed to regard as characteristics are merely results of this location. The perfection of glass-making did not produce very marked transformations, for this was already perfected before men could fully enjoy the advantages of glass-manufacture (they were even greater in antiquity than in the middle ages) -- they made living more comfortable in certain climates and great demands on the art of living possible, even in the north.

Houses in several stories with shops on the level of the ground and with windows in the different stories next the street had already been invented in great cities in antiquity, and therefore their exteriors, with the exception of rich architectural ornamentation, must have differed little in general appearance from many modern structures for like purposes, while the improved stairway construction in the interior is a recent attainment, even in rented houses.

Openings of 9.8 to 13.1 ft. in the clear for shop fronts are common in Pompeii and were likewise so in Rome; between them is generally inserted a narrow entrance leading to the interior of the house.

The reduction of the wall of the lower story next the street to a few narrow supports (piers) and great openings (see the

plan of the House of the Tragic Poet in Fig. 553,99) with 4 or 5 upper stories above it and penetrated by windows (we may recall the houses of Rome from 59 to 69 ft. high) is accordingly no architectural merit of the modern period; only the improved method of closing the openings is its work, and plate glass has made possible in the north, what had long existed in the south without it; the great and advantageous show windows for goods next the street. The open air display of the south was placed behind glass panes in the north, and the buyers were compelled to make their purchases behind the latter, instead of on the street as formerly.

400. Rural Buildings.

With the dwellings in the level country were also frequently combined farm buildings. Vitruvius[393] mentions these in his Book 6, 6, barns, granaries, hay and forage sheds, bake-ovens, wine-presses, oil rooms, stalls for oxen, sheep and goats, with data of dimensions. Whatever is worth knowing of this will be treated in the next Chapter.(On the Rural Villa).

401. Syrian-Roman House.

From the normal plan of the Roman house on the Italian peninsula differs substantially the plan of the dwelling met with in the conquered provinces. It is made necessary there by different climatic conditions, by the lack of certain building materials and by the earlier civilization of the native peoples.

This most strikingly occurs in the house of central Syria. There in the treeless Hauran, the requirements for the practical construction become entirely different. Instead of the girders occur arches of semicircular or elliptical form and stone slabs must be substituted for beams. The gable and hip roofs give place to the Asiatic terrace roof, the access of light for the interior does not pass through openings in the roof, but through small side windows placed in the outer walls. The rooms are of moderate height and lie in two stories above each other, while the state rooms extend through both. Stone stairs in the interior or on the exterior lead to the upper story. The construction entirely of stone enables the buildings to resist the effects of weather and the power of the elements, earthquakes, as well as injury by fire or water. They required fewer repairs, which may have chiefly consisted in

replacing the layer of earth on the terraces -- peculiarities that have made the houses habitable up to the present time.

The greatest number of them date from the Christian period, others belong to the local native art before the 4 th century. These are likewise divided into dwellings for the lowest class, the middle class, and for those of highest rank, just as everywhere in the world and as shown in the description of Grecian and Roman houses. The lowest class of land owners were satisfied with stone huts, that were covered with stone slabs or vaults, plain structures of cubical form, composed of one or two rooms. Even the most beautiful of these houses exhibit in plan no more than an assemblage of larger and smaller rooms.

Figs. 562 and 563 [394] give the plan, view and section of such a stone house at Douma, after the drawings of De Vogue, in which external and internal stairs occur, like the atrium or the hall with lofty vaults and extending through two stories, with direct entrance from the exterior and the stairs to the upper apartments. The public life passed in the hall, beside it are arranged the rooms for servants and some sleeping cells, above these in the upper story being the rooms for the women and children. The present occupant, the sheik of Douma, dwells in it just like his predecessor in the 3 rd century. On a house in Chagga, the stone stairs on the exterior lead from the ground to the terrace roof, which is only accessible thereby.

Note 394. Reproduced from De Vogue.

At the house of a man of position given by De Vogue [395], (Plate 11) -- of the sheik of Amrah -- one passes through an arched gateway, characteristically flanked by a three-story and simply treated tower, first crossing a court measuring 32.8 × 34.8 ft. into a hall extended through two stories, or the great reception hall, that is surrounded by sleeping cells. To this adjoins a building of a single story, that contains the stalls for 11 horses and consists of a central room with side rooms around it, into which open the cribs for the horses. The stone beams are carefully jointed and dressed in regular form.

The same lack of wood compelled the dwellers in the Hauran to use as substitutes stone walls and arches, with stone beams

and slabs for the ceilings, likewise made it necessary to employ stone for closing door and window openings. There occur instead of solid slabs of stone, perforated basalt slabs, and those of gypsum with inserted glass, with lattices of wood and iron, as in the East today. The doors are almost exclusively of stone and move on pivots sunk into holes in the lintel and sill; many bear inscriptions of the period from 169 to 550 A.D.

402. Roman-African House.

The model for the Roman-african house is the Grecian, in which the various rooms are placed around a central court. Generally a single entrance with a vestibule leads directly into the rectangular or square court surrounded by porticos, and which was adorned by plants, beds of flowers and fountains. Sleeping rooms extend behind the portico, and for receptions, there is to be found a great hall (oecus) behind the court into which it opens by one or more doorways. In larger houses are also found other small courts, surrounded by columns on one or three sides, the rooms lying behind these always forming a separate dwelling by itself. Baths are also arranged there.

Like those in Pompeii, these buildings are built in one story, and most are covered by terrace roofs, although flat tile roofs are not excluded. The external walls are strongly built of stone masonry 1.64 ft. thick.

Fig. 564 [396] gives the ground plan of a house at S. Leu in Algeria, that covers a ground area of 81 × 77 ft. The entrance with vestibule is found at the southeast corner, and the way through this leads across a court with columns and adorned by fountains, to the great main hall (oecus) opening toward the west. Its front is divided into three openings by two pillars, the two outer ones showing grilles. The floor is of rich mosaic.

Note 396. Reproduced from Gsell, S. Les Monuments Antique de l'algerie. Vol. 2. p. 17. Paris. 1901.

The ground plan of a larger house at the same place is shown by Fig. 565 [396], where A is the vestibule projecting toward the street, B is the court surrounded on 4 sides by 20 columns, whose porticos have flat tile roofs, and at its centre as well as on thse sides are basins. C, D and M are connecting passa-

passages, F, G, H, I, K and L are rooms, N and O are little gardens cut off by colonnades, P - P is a gallery 105 ft. in length, Q is the great reception hall, measuring 27.5 × 40.7 ft., whose floor was decorated by rich figure mosaic,(now in Museum at Oran, and R is the cistern.[397]

Note 396. See the same for further informatisn.

Chapter 16. Villas.(Urban and Semiurban, Hunting, Rustic and Princely Villas).

403. Villa.

While the house offered no more or very little more room than was absolutely required for constant use or occupation, the villa, especially in and near the capital of the empire, assumed a greater character and in its appurtenances went far beyond actual needs. State apartments, baths, promenades, and rooms for athletic exercises are found with the living rooms. Building in several stories was avoided, or it was used only when it resulted in certain cases from the location of the building on uneven and inclined land. Then for designs in several stories, the terraced recession of the stories permitted the structure to appear more pleasing.(See Villa of Diomede in Pompeii). Otherwise on a level site, the various rooms were placed around the atrium and peristyle, only the inferior rooms finding their places in a single upper story.

Just as little as for the city house was a greater care taken for the exterior or the facades of the villa. The chief emphasis was placed on the arrangement of the plan and the splendid treatment of the interors.

404. Situation.

Sites were preferred on ground near the seashore or even built into the sea itself, in order to be more secure against malaria; remains of buildings and views in Pompeian mural paintings indicate this. But they were likewise erected in the interior of the country, as evidenced by the ruins of villas in the Roman Campagna (Roma vecchia), near Tusculum, Tivoli, etc.

Regular country vacations had become a need for the higher classes. The Sabine and Alban mountains gave in summer pure mountain air, the Gulf of Naples afforded in spring and late autumn the pleasant warmth of the southern climate, and the enclosure of sycamores on one of the lakes of upper Italy permitted business at home to be forgotten. Everywhere in these localities were found occupied country houses or splendid palaces. Horace says of this:-- "they leave to the countryman no more arable land; the sycamore supplants the vine-covered elm; in place of oil plantations occur laurel and myrtle, with

beds of violets instead of turf. Artificial grottos, islands, fish ponds, walks and porticos accompany these buildings -- plains are transformed into hills; where the eye sees trees was never earth. Warm baths with domes, adorned by the most costly marbles, temples of Neptune and of Hercules are accessories of the villas of the great. One reads in the poems of Statius, which bear the true local color of the country, "if one will call forth from ruins a phantom of magnificence, who formerly joined himself to the chance of splendid nature, in order to make the existence of the rich and great more enviable.[398]

Note 398. See Friedlander, F. Darstellungen aus der Sittungsgeschichte Roms in der Zeit von Augustus bis zum Ausgang der Antonine. 6 th edit. part. 3. Leipzig. 1890.

The love of the sea likewise caused the preference of the seashore for villa designs. (Ruins near Antium). The Villa of Pollius Felix near Sorrento is lauded by Statius; Pliny had possessions in Etruria, on Lake Como, near Beneventum and near Laurentum; the orator Regulus possessed such in Etruria, Tusculum and in the Campagna; Vopisius owned a villa near Tibur, where two palaces stood opposite each other on both banks of the Anio.

The country occupied by the Tuscans is described by Pliny in the following words:-- "Imagine a vast amphitheatre, such as nature alone may produce; a widely extended plain is girdled by mountains; the mountains are crowned by ancient forests and have an abundance of wild animals. Woods extend downward on the slopes, between them being hills of rich earth (for rocks are here sought in vain), which are not inferior in fertility to the most level fields, and which ripen a fortunate harvest there, even if somewhat later. Vine covered hills extend around below and afford a widely reaching view. Where these cease, there follow fruit orchards forming their border around the plain. This contains meadows and grain fields. - - - The meadows are bright with flowers; for everything is nourished by constant streams. But in spite of the abundance of water, there are no swamps, since the sloping ground gives to the Tiber the water received, that it cannot absorb. This navigable river runs through the midst of fields."

"Like a building of the state" rose near Laurentinum the hall, furnished with windows on both sides, that might be closed, with an outlook toward the sea and upon the gardens fragrant with violets. Interesting remain the descriptions of the surrounding landscapes and of the gardens, as well as of the restful places near the Tuscan country house;[399] one thinks himself transported to the Villa Albani, Pamphili, or into the Vatican gardens, (Villa Pia), if there are mentioned the forms of animals cut in box trees, the walls bordered by thick hedges, the shaded ways of the racecourse enclosed by cypresses, laurels or sycamores covered by ivy, the letters formed of beech trunks, that compose the name of the owner or of the landscape artist. "Mary" appears today in gigantic living green letters on the well known lawn of Villa Pamphili-Doria. Just as inviting is Pliny's description of the bench of white marble placed at the upper end of the walk, covered by vines, that were supported by four small columns of Carian marble; water flows from the bench into a marble basin, on whose margin stand heavy bowls with lighter dishes of food swimming around on little ships and on birds on the surface of the water therein, thence the eye penetrates beyond the stream of water of an air cooling fountain into a sleeping apartment gleaming with marble, whose windows are covered by vines, permitting the interior to appear in a subdued light. "Men lie here as if in the forest and even the murmur of the fountain is not wanting."

Note 399. The Letters of Pliny have given opportunity for many restorations of the villa in juestion, one of which is published in Canina (Sez. 3 pl. 240). Another was attempted by Scamozzi (see the appendix to the Italian edition of Mazois, F. Le Palace de Scaurus etc. Milan. 1825), and W. Stier has buisied himself therewith in recent times.(See Architektonischen Erfindungen. Edited by H. Stier. Heft. 1. Berlin. 1867). The least happy among these is that of Scamozzi. Especially to be examined is : Winnefeld, H. Tusci und Laurentinum des jungeren Plinius. Jahrb. d. Kais. Deutsch Arch. Inst. Vol. 6(1891). p. 200 - 217. Berlin. 1892. The Tusci was in the upper valley of the Tiber near Tiberinum and the Laurentinum was on the Latin seacoast near Laurentum, which he fully describes in letters to Domitius Apollonaris V, 6 and Gallus

II, 17. His villas on Lake Como were similarly arranged, according to various indications.

How charming is also the description of the space near the summer house, shaded by four sycamores and animated by a spring, its sleeping room decorated to the cornice by marble, the paintings of the ceiling representing branches with birds thereon. Then again the fish pond beneath the windows of a room, into which the water plashes from a marble basin! Here arranged above the dressing room is the Sphaeristerium for several kinds of physical exercises. The useful beside the pleasant!

The Laurentinum lay 15.53 miles from Rome and in convenient proximity to Ostia, and it lonsisted of house, garden and an area of sand. A large landed estate was not connected with it. "It was a country house in the narrowest sense of the word." The nucleus of the villa formed a series of rooms, which strongly recalled the arrangement of the city dwelling; there lay along a common longitudinal axis successively an atrium, a small semicircular court, a cavedium and a triclinium.

Winnefild[400] (p. 204, 212) has given plans of the villas mentioned, which possess much internal probability."Very modest in all their proportions, but in the principal parts of the plan, the two country houses of Pliny were not essentially different from Hadrian's"

405. Semiurban and Rustic Villas.

Villas of two kinds were distinguished in antiquity:-- the villa pseudourbana, the country house of the rich man, and the villa rustica, the farm buildings -- the farmstead with its living and farm buildings, of which those intended for the master and his family were termed Aedificia pseudourbana, since they were built after the plans and were furnished with the splendor of the city house.

406. Urban Villa.

The urban villa was in time distinguished from these, and which was understood to be a dwelling among beautiful surrounding landscapes and equipped with all the luxury of the city.

With the pseudourban villa was frequently connected a covered promenade and a small casino, containing but few rooms, to which the master might retreat for an undisturbed life or for work at certain times. Rich plans of gardens, shrubbery and

beds of flowers, basins with spouting water, etc., surrounded the building. Vitruvius would place the peristyle at the entrance, as arranged at the Villa of Diomedes in Pompeii. On the left of the entrance doorway are found the bath and apodyterium, the tepidum and cladarium, in the vicinity being a kitchen with a hearth.(men loved hot drinks after the bath). The heating was done from the kitchen by a hypocaust, with this being connected a hollow tile lining of the walls. A garden followed in the plan, then a sleeping room with ante room, a passage with tablinum and a portico, that opened on a terrace extending to the garden at a lower level. Adjoining this was an uncovered walk over the portico enclosing the garden.[401]

Note 401. Compare the ground plans and sections in Mau, p. 351 - 353.

407. Urban Villa; Private Palace.

Mazois[402] sketches an attractive picture of a city villa, or rather of a Roman private palace, but of nothing more than it. Nothing further remains in the localities of all the former magnificence; it only lives in literature.

Note 402. In Le Palais de Scaurus, ou Description d'une Maison Romaine. Plate 2. 4 th edit. Paris. 1869.

In the similarly magnificent manner was indeed a part of the villas designed and furnished, whose ruins remain scattered along the shores of Pozzuoli and Baiae, and which are connected with the most famous names of Roman antiquity. To these are also joined the Villa of Maecenas in Tibur, the gardens and Villa of Sallustius in Rome, of which the Villa of Diomedes in Pompeii was but a faint imitation.

408. Hunting Villa.

In comparison with the preceding palatial villas, the so-called Hunting Villa at Fliessem appears somewhat rustic, since in accordance with the rougher climate the atrium and peristyle surrounded by columns are wanting to it; the latter was replaced by fenced (farm ?) courts, that lie without the building. Passages and rooms were regularly arranged and in part had indirect light and indirect access. Each of the better rooms was furnished with its own separate heating chamber and warming arrangements; the angle of the building toward the court was occupied by a bath with its heating chambers. Imposing and recal-

recalling a passage of Pliny about his Laurentinum is the great vaulted passage (promenade) between the projecting and indeed tower-like circular apartments, which occupy the entire front of the structure. The magnitude of the ground plan, about 197 × 210 ft., as well as the splendid mosaic floors, that were found in the rooms, permit the conjecture of a distinguished owner.[403]

Note 403. Compare Schmidt, Ch. W. Die Jagdvilla Fliessem. Treves. 1843.

409. Court Buildings in Tributary Provinces.

Many things in the arrangement at Fliessem recall those small buildings with courts, whose remains are everywhere preserved in the tributary provinces, for example, near Sinsheim,[404] Pforzheim, Brötzingen, Messkirch in Baden, and other places.

Note 404. Cohausen, A. von. Der Römische Grenzwall in Deutschland etc. Wiesbaden. 1884. -- Further, Näher, J. Die Bauliche Anlagen der Römer im Zehntland etc. Carlsruhe. 1883.

410. Rustic Villa.

The rustic villa has a tangible support by the excavations near Boscoreale made by Vincenzo de Prisco in the years 1893-4, who uncovered on his land a "country farmstead", similar to several others discovered in Stabiae in the preceding century, but again destroyed. Fig. 566[405] gives the plan of the design; the purpose of the different rooms is as follows, according to the letters attached.

Note 405. Reproduced from Mau. Fig. 5 on p. 356.

A. Court.
B. Kitchen.
C. Heating chamber of bath.
D. Dressing room of bath.
E. Tepidarium of bath.
F. Caldarium of bath.
G. Privy.
H. Stable.
I. Room for implements.
K, L. Sleeping rooms.
M, N. Dining room with anteroom.
O. Bakery.
P. Wine Press.
Q. Corridor.
R. Uncovered room for wine vessels.
S. Room for unknown purpose.
T. Threshing floor.
U. Reservoirs for rain water.
V, V, V. Sleeping rooms.
W. Room with pit for fastening vertical supports of the press lever.
X. Room with hand mill.

Y. Oil Press. Z. Room with machine for crushing olives. At P are the press floors, the tanks for must, with holes especially arranged for the vertical supports of the pulleys for raising and lowering the pressing lever. (1 - 6).

The principal entrance lies at the end of the court A, and it is wide enough for wagons. Thence one passas to the dwelling with the kitchen B, the bath rooms D, E, F, the privy G, the sleeping rooms K and L, and the dining room with the anterooms M and N, the latter occupying the entire northern end. At the east side of the court lies the press house with a passage before it, from which one passed into the great uncovered area R for wine vessels. Adjoining it is a larger room S of unknown uses, and next this is again the threshing floor T. Adjacent to the room S are the oil press Y and rooms for crushing olives and hand mills. Fig. 567 gives a view of a storehouse with clay vessels, that was found in a building at Ostia, and Fig. 568 [406] is that of an oil press, after sketches of Saladin at Chond el Battal, which scarcely requires further explanation.

Note 406. Reproduced from L'Ami des Monuments. p. 79. Vol. 1. (1887).

Of the second "Villa in the so-called Julian country", Fig. 569 [407] gives a ground plan, that shows the same type as the Villa near Pisanella. [408] Rooms A to D belong to the dwelling of the owner (D is a portico, C a vaulted room, E a peristyle with porticos on east and south), while E to V are rooms designed for farm use; among these, H is the wine press, G is the storehouse for wine, in which 4 clay vessels were found in their original places, and S is the granary. The bakehouse P is immediately recognizable, the adjoining room M contains the privy "(perfectly preserved").

Note 407. Reproduced from Notizie degli Scavi di Antichita. 1897. p. 391.

Note 408. See the same.

411. Oil Factory.

Of an oil manufactory indeed belonging to a larger farmstead and monumentally constructed, the views in Figs. 570 to 573 [409] afford a representation. The walls are of stone timber work (rubble between stone beams) and are built of ashlars, the plan

having an extent of 66.2 × 61.2 ft. and being divided into 4 aisles, two of which are separated by rows of pillars.Between the 3 rd and 4 th rise a row of vertical posts for 6 presses with masonry carried high above them.(Fig. 571). Piers and arches are solidly built of ashlars and are shown in Fig. 573, and Fig. 572 gives a general view of the oil manufactory at Sgasun in Algeria.

Note 409. Reproduced from Gsell. p. 31, 29, and plates 75, 76.

412. Prince's Villa.

Villas of princes occupy greater limits and are not always uniform structures in the modern sense; "they were somewhat different from mere villas, being rather an epitome of many separate state buildings of the most varied kinds and forms."

Thus Villa Hadrian near Tibur, besides the living and state apartments, comprised a capricious collection of the most famous buildings of the ancient world, which Hadrian caused to be imitated on a reduced scale, and whose ruins are still today equally valuable and interesting in technical, archaeological and picturesque respects.

The natural landscape surroundings were here changed by beautiful transformations in even a higher degree than for the suburban villa, and which was not limited merely to the designing of forests, roads or terraces; but valleys, lakes and water courses were artificially constructed. The valley of Canopus, for example, was 590 ft. long and 230 ft. wide and was cut in the tufa, once forming a great basin for water. A likewise very extensive plan of Villa Gordian may be deduced from the ruins near Tor de' Schiavi in the Roman Campagna, the Villa of Domitian covered a larger area than the present small city of Albano. Very imposing in extent are likewise the remains of the Villa of Tiberius on Capri.

413. Villa of Hadrian.

Fig. 574 [410] represents the extent and arrangement of Villa Hadrian near Tibur. At the entrance is a great court enclosed by porticos, directly near it being a theatre. Beyond the stream lay a second larger theatre, then the buildings of the so-called library, the double porticos over 656 ft. long mentioned in the vicinity of the "Poikile", next the proper palace

buildings with stadium and baths, then the Canopus or valley previously mentioned and surrounded by low terraced structures, whose southern end was terminated by a great niche.(Compare Art. 220). There succeeded the so-called Academy and other buildings, that are variously named, definite information concerning them being given by Winnefeld in his splendid publication.

Note 410. Reproduced from Winnefeld.

411. Compare Winnefeld, H. Die Villa des Hadrian bei Tivoli. Berlin. 1895. Third extra part of Jahrb. d. Kais. Deutsch Arch. Inst. -- Then also, Gusmann, P. La Villa Imperiale de Tibur, Villa Hadriana. Paris. 1904.

The principal palace (Fig. 575 [410] contains all arrangements and state apartments, that appertain to holding an imperial court. Summer and winter palaces are to be distinguished. The eastern palace is more prominent of the two mentioned, which comprises the great court with a portico of two aisles and the remarkable octagonal building (Fig. 575), and which must be understood as a state hall. The great palace stands in its entire extent on ground belonging to the government, and it has been so thoroughly uncovered in at least the important portions, that the direct examination of the ruins teaches everything, which may still be determined." The small (western) palace likewise has for its centre a court surrounded by porticos, that was enclosed on three sides by buildings; this structure was intended for the personal use of the emperor. The artistic ornamentation of the buildings, that were completed in about 7 years (127 - 134 A.D) is not of the highest type; it did not keep equal pace with the fame otherwise connected with the name of the art-loving prince. The quality of the execution is also inferior; much is puerile in a structural respect (for example, the construction of the architrave and columns). the costly building stones so strongly coveted at that time are only modest and employed in small dimensions, frequently only as slab facings instead of massive ashlars. Mosaics adorned floors and walls; even on the vaults do they appear still; splendid candelabra, vases and sculptures, the latter frequently imitations of famous originals, complete the internal ornamentation. Winnefeld is of the opinion:-- "Not from frugality, but from necessity are the buildings thus and not otherwise

constructed; the powers at command did not suffice to produce something more substantial in a brief period." It may be that the numerous public buildings occupied the great multitude of trained workmen in different places; but Hadrian's Gate in Athens is likewise no masterpiece in composition and execution, just as little is that at Adalia, of which Niemann says, that it is rich and effective as a whole, yet is wrought in detail without refined invention.(For example, the smaller incisions between the separate leaves are produced by the drill)."Paint thy gourds, you know nothing of architecture," said Trajan's architect Apollodorus to him once.

Nearly 2000 years have flown past (actually 1767) since Hadrian made his entry into the Villa and there dictated laws to the world; its splendor has sunk into the dust, and yet its charm is strong today. It affords to us information concerning the methods of construction by Roman builders, its ruins permit us to look into the heart of the nature of their technique, and we are strongly stirred by the whispering of the cypresses and pines, which rise from the olive forest, by the blooms and flowers of the bushes in warm spring days, that seem to tell us of past ages. A fortunate bit of earth, connected by art and by the classic beauty of a southern nature!

Chapter 17. Imperial Palaces.

Expenditure for Construction and Furnishing; Floating Palaces.

414. Imperial Palaces on the Palatine.

The grandest imperial residences originated in Rome after Augustus had fixed upon the Palatine as the imperial residence and his successors adhered to this decision. Tiberius, Caligula, Nero (the latter connected the imperial gardens on the Esquiline with the Palatine by building over the Velia and the valleys between the Palatine, the Caelian and the Esquiline), Domitian, Hadrian, the Antonines, Septimus Severus, Elagabalus and Alexander Severus were successively active here as builders by extensions, new structures and restorations, and by embellishments.

Even these works have fallen. Nowhere more than here have Goethe's words touched my heart:-- "That the romance of a country is a quiet feeling of sublimity under the form of the past, or the same thing, of solitude, of absence, and of retirement."

415. House of Livia.

These imperial structures had no similarity to the Roman private houses; their models are rather to be sought in the royal citadels of Antioch and of Alexandria, or in the royal palace of Pergamon. The detached House of Livia, that the father of Tiberius occupied, and to which his mother again retired after the death of her first husband, already shows an arrangement of the interior independent of the normla Roman house plan. From the vaulted vestibule, one passes into a great atrium, into which open three rooms of equal depth; in the middle being the tablinum with the left and right wings beside it, at the right end being the triclinium and the guest's room.(Fig. 576). These are the reception or state apartments. A narrow passage leads from the atrium to the rooms at the rear, that are assumed to have been sleeping and living rooms, bath, and shops.

416. House of Augustus.

Still more independent of the Roman dwelling appears the plan of "Domus Augustana or Augustiana"(both forms are verified by inscriptions) on the Palatine, the plan of the loweest story of which may be restored with certainty. (Fig. 577 412
On the eastern front next Area (Place) Palatine rose a portico

with 22 columns of grayish-green marble (cipolline); this formed the entrance to the Palace (also called Domus Flavia or Palace Flavian). As in the House of Livia, three doorways led to the three vast internal apartments lying beside each other, to the great central hall -- the throne hall (aula regia) --, then into the basilica on the right -- the hall of judgement--, and into the palace chapel on the left -- that of the family deities (lararium). Behind these and surrounded by small rooms on two sides, follows the great columnar court (peristyle), on its southern side being the great banquet hall -- the conatio Jovis, the ancient triclinium --, at whose two sides was a nympheum and a smaller and cooler summer dining hall. But it did not end there. To it belonged also the imperial living apartments, still beneath the former Villa Mills, and which were arranged about a square court. Then followed the so-called stadium, which must more correctly than magnificently be termed a state garden surrounded by porticos, and which has been entirely uncovered since 1893. It is assumed for the portico, that it was first added under Septimus Severus, while the great niche with half dome is supposed to be original. From the time of Theoderic dates the great elliptical building inserted at the southwest end. The library adjoined the northeast side (Fig. 577) and farther in this direction was the great Temple of Apollo. A vast mass of extensive and rich structures, and which must be regarded as a whole, will afford us a true conception of the Augustan imperial palace.

Note 412. Reproduced from Baedeker, K. Mittelitalien. By Ch. Hülsen. 13 th edit. Leipzig and Rome. 1903.

Tognetti,(Fig. 578) has attempted to give a view of the exterior and interior, with which I can agree, especially concerning the latter. Grand gust have been the effect of the throne hall upon one entering, if we remember that the breadth of the room exceeded by about two-fifths that of the middle aisle of S. Peter's at Rome, both being covered by coffered tunnel vaults. If we conceive the decoration of the walls by columns and statues, with precious kinds of marbles, the colossal basalt statues in the niches, the apse with the throne, the pavement animated by slabs of porphyry and of marble, the whole bathed only in a northern side light falling through an

end wall, with the same magnificence once shone the basilica and the lararium, the columnar court and the triclinium -- worthy of the ruler of the world then known!

417. Enlargement of the Imperial Palace on the Palatine.

Tiberius extended the Palace on the west. From Palace Tiberiana, Caligula desired to build a bridge over the Forum to the Capitol, in order to more conveniently associate with the Capitoline Jupiter.

Easterly from the so-called Stadium, Septimus Severus had his Palace erected, whose general plan can no longer be determined.

Besides the great Temple of Apollo mentioned , there were also the Temples of Jupiter Victor and of Magna mater, that covered the upper surface of the Palatine, on the southwest slope of which extended into the plain the Circus Maximus, already built under the kings, enlarged by Julius caesar and his successors and holding 200,00 spectators.

418. Golden House of Nero.

Where the Colosseum now rises were once the gardens, the parks peopled by wild and tame animals, the meadows through which flowed an artificial lake, and the Golden House of Nero. It covered substantially the land on the Velia, the Esquiline and the valley lying between them. The halls and rooms of the emperor were covered with gold and set with precious stones and pearls; the noblest statues plundered from Greece and Asia Minor served for their ornamentatism. When the Palace was so far completed, that Nero could occupy it, he said contentedly; "he now began to live like a man."

Otho appropriated after Nero's death about $2,750,000 for continuing the building.

Vitellius found the whole "unworthy of an imperial residence;" he desired to even surpass Nero, if fate had given him a longer period of rule.

Vespasian and Titus had the larger portion torn down, replacing the destroyed part by buildings that served for the pleasure of the people. Nero's gilded bronze statue, which stood in the fore-court of his Palace and was 118 ft. high with the halo of rays, was changed to an image of the sun god,and it found its place in the vicinity of the Colosseum, not far from the Meta Sudans.

419. Palace of Domitian.

Domitian accommodated himself yet more richly, so that Plutarch (Publicola, 15) could say of his Palace:--"Whoever beholds in this a single gallery, princes' hall, bath or the like, would feel tempted to say to Domitian something similar to what Epimachus said to the extravagant man:-- "No, thou art no friend to mankind, it is a disease, a rage for spending." He would say to him:-- "This is neither piety nor ambition in you, it is a disease, a rage for building; like ancient Midas, you desire to have everything of only gold and marble!" The same Plutarch says in enforcement of this statement, that the fourth capitoline Temple by Domitian had columns of Pentelic marble, and that the gilding on this building cost not less that $13,875,000. What later period can show the like in its size, magnificence and grandeur of programme of the building? Only the French and late Italian Renaissance, in which princes and the great similarly excelled each other in their palaces and established like requirements.

The state and reception apartments in Rome, the extensive living and service rooms, the temples and the palace chapel, the stadium, and state gardens and the buildings for sports, or in short:-- Palace -- Temple -- Circus. In Versailles and Caserta:-- Palace -- Palace Chapel -- Theatre! Requirements or parts, which became similar in all princely residences of the 18 th century for the entire civilized world, and which still exist today.

The House of Jacques Coeur at Bourges cost $2,000,000, and that of Richelieu at Versailles an equal amount, that of Fouquet in Vaux $3,600,000, and finally the Royal Palace in Versailles, according to existing documentary evidence, [417], $12,532,229.40, or at the present value of money, $40,000,000, without allowing for forced labor and the national resources.

Domitian spent $13,875,000 for the gilding of the Temple of Capitoline Jupiter; he must have reckoned not much more for his Villa on Lake Albano. Did Louis XIV surpass Nero or Domitian? The question may well be answered by "yes"; but on the other hand, Friedlander [418] (p. 107, 999) is of the opinion, that the architectural luxury of the period from Augustus to Vespasian has never been attained at any other time.

420. Palace of Diocletian in Spalato.

An entirely different picture is presented by the Palace of Diocletian, that indeed only originated after he had laid down the purple, and therefore under other conditions.

Corresponding to the Roman camp is the Palace of Diocletian, whose outer walls enclosed a rectangle 650 × 619 ft., within which nearly the entire modern Spalato is concealed. Two streets intersecting at right angles divide the interior into four portions, each of which contains a great peristyle surrounded by rooms. Two of these open courts, that directly adjoin the imperial residence, had at their centres temple-like structures, one of which was on the Tuscan plan, the other being a domed building, internally circular and externally polygonal in plan and surrounded by columns. They pass for Temples of Esculapius and of Jupiter. That first named must be regarded as the chapel of the emperor, the other as intended for his tomb, according to Roman buildings formerly serving for similar purposes.

On the side next the sea a portico occupied the entire width of the Palace, the covered promenade, on which opened the imperial apartments, while the three landward sides were protected by square and polygonal towers.(Fig. 579[414]).

Note 414. Reproduced from Lanza, F. Dell' Antico Palazzo di Diocleziano in Spalato. Pl. 1. Trieste. 1855.

The two portions of the Palace toward the rear served to receive the imperial courtiers and the guard. From the imperial apartments one passed from the intersection of the two streets, in the direction of that separating the Temple and Tomb, through a circular vestibule adorned by an anteroom. Good architectural views may have been furnished by the interior of the Palace with its monuments, courts, porticos, and fine perspectives in the time of its splendor. Gardens and parks must have been found outside the enclosing walls, and which led to the three architecturally treated gateways of the three landward sides.[415]

Note 415. Compare Adams, R. Ruins of the Palace of the emperor Diocletian at Spalato in Dalmatia. 1764. -- Further, Canina. Sez. 3. Pl. 239.

The four corner towers were about 16.4 ft. higher than the

others, that only extended to the height of the walls, as may be concluded from the drawings of Cassas and Lanza. The statements concerning the extent of the enclosing walls differ. The angles at the four corners of the protecting walls are not right angles, though intended to be such, the variations are defects in the execution, as well as the differences in the measurements of the sides. The southern side still remains to a height of 7.7 ft. and is somewhat longer than the northern, the eastern side measures 647 ft. and the western 665 ft.

The parts of the plan in solid black in Fig. 579 correspond to what still remains, and the hatched portions are doubtful restorations, with which Adams, Cassas, Lanza and Mothes have occupied themselves. Those of Lanza appear most acceptable and were therefore adopted in Fig. 579.

In reference to the peculiar vaulting of the Tomb-Temple and the form of its roof, and to changes in the form of the building, the necessary statements were made --"innovations" that -- according to Mothes -- in spite of and perhaps even on account of its inorganic occurrence as a product of a fresh intellectual movement, are to be regarded as the results of foreign influences (Jerusalem, Palmyra), as for example, the consoles on the shafts of the columns, the curvature of the architrave, and the geometrical ornamentation in the soffits. Not all have a satisfactory effect. The best still remains the Corinthian capital at the angle of the entablature forming an octagon on the Tomb-Temple, and the arrangement of the blind arcade at the Golden Gateway.

The dressing of the ashlars is still good, the drill is immoderately employed in the treatment of the ornamentation, the brick masonry is executed with too great a use of mortar. Where Mothes finds a "transformation of the practice of vaulting" or even a"dissolution of the dome into a star vault" is hard to understand. The domical vaulting is a caprice; the indented horizontal arches are practically worthless, only the small niche vaults in the rotunda show an advance in jointing stone masonry.

A bird's eye view of the Palace is given by Fig. 580 with its interior of many forms within the rigid enclosure of a fortress wall. located close to the seashore, surrounded by

a southern vegetation, the structure rises before the background of the wild Kartz mountains; from the Jadro spring in Mosson in them drinking water was brought 6.83 miles to the Palace. -- Granite columns from Egypt, columns of porphyry and verde antique, must have made their way to the coast of Dalmatia in order to decorate Diocletian's buildings.[417]

Note 417. Compare Die Oesterreich-Ungarische Monarchie in Wort und Bild. Küstenland und Dalmatien. Heft 13. Spalato. Vienna. 1891-2.

421. Palaces in Arles and Treves.

In Arles and Treves have been preserved to us the remains of two Palaces of Constantine the Great, well meriting consideration. The first is near the Rhone, was built in 306-330 A.D., was occupied until in the 13 th century by the ruler of the province at the time, and it is now preserved as a historical monument. About 50 years since, this structure was still known as "Palace de Trouille" as a dwelling for poor people, by its name recalling the gilded rooms of the Byzantine "trullum". Characteristic there are the Eastern-Roman semicircular projecting apses and the mixed masonry, which is carried up with two or three courses of white limestone ashlars alternating with two courses of red bricks and with thick mortar joints everywhere. Circular winding stairs are built around a Newell, leading down to the water level of the Rhone, and are still visible. Not far from the Palace were located the baths and a circus -- thus were here a palace and a theatre!

Similar forms and construction are also shown by the Palace in Treves erected for the same emperor (Figs. 581 to 583). It was not characterized by sculptures and rich ornamentation on the exterior; it rather produced an imposing effect by its great architectural masses. The interior was penetrated by heating chambers in the lower story, that were accessible from the exterior, and from which the warmed air was admitted to the apartments. The principal weight was placed on the splendid treatment of the interior, as on the Palatine.

The architect Ch. W. Schmidt, of great merit in relation to the ancient buildings at Treves, fixed the ground plan as in Fig. 581 and gave a doubtful extension thereof, which had much in its favor, but was overthrown by further excavations.(Fig.

582). What Schmidt accepted as the apse of a hall in 3 aisles (royal throne hall ?) has become a rotunda, before which is placed the long hall F with the apse G. this terminated the great court surrounded by porticos in 3 aisles. The design must here have consisted of a moderately high front building with the extent of the dotted line in Fig. 581, which was connected with the state building by wide porticos. The parts of the building mentioned enclosed a great fore-court and thus formed a grand whole.[418]

Note 418. Compare Baudenkmale der Römischen Periode und des Mittelalters in Trier und seiner Umgebung. By Ch. W. Schmidt. Heft 2. p. 16. plates 2, 3. Treves. 1845.-- Further, Correspondenzblatt der Westdeutschen Zeitschrift für Geschichte und Kunst. Jahrg. 22. (1903). No. 7.

422. Furnishing and Equipment.

And now a glance at the internal furnishing and equipment of the dwellings, that already varied greatly in kind and magnificence.

The arrangement of the house and the climate caused more attention to be paid to the splendid furnishing than to comfort, according to our ideas in the North. With increasing care for luxurious treatment, men first sought to create more spacious proportions in the residences of the wealthy by increasing the height of the atrium (Crassus had made this only 12 ft. in his house, while Scaurus raised his own to 38 ft), then giving to the state apartments and dining room dimensions enlarged in all three dimensions, also supplying these rooms with heated floors (hypocausts); but the magnificence in the interior was increased to the greatest degree, chiefly by the introduction of costly building materials, pillars and pilasters of pavonazetto, architraves of white marble from Hymettos and Carrara, columns of oriental alabaster (Calistus had 30 of these in his dining hall), of Carian, Synnadic, Chian and Laconian marbles, of granite from Syene and other places, had become common; the surfaces of walls were adorned with onyx and covered with costly variegated African, Phrygian and Laconian stones, in the use of which the rich families rivaled each other during the period from Augustus to Nero.

Movable paneled ceilings in the dining halls are mentioned ,

which were changed at every course, and from which flowers and fragrant water were dropped, gilded ceiling panels with inlays and panels of ivory, ceilings with glass mirrors, mosaic ornamentation, vaults with colored pictures in glass mosaic and domed halls, that rotated about their axes during the day and night. Between the brightly colored columns of the courts were arranged flower beds, shrubs, bushes and even groups of trees; water from fountains streamed through silver pipes into silver bowls or into basins walled with marble; purple awnings kept off the sun's rays, that would otherwise fall upon the costly mosaic floor. Perfumes from Arabia floated through the rooms, and perfume burners were not lacking on the tables.

Therewith the luxury of flowers likewise increased to the highest degree, especially for the decoration of rooms at banquets, and the outlay was unlimited, particularly if the flowers must be procured in winter. Thus for example, the flower decorations of roses in winter cost $212,500 for a banquet of a friend of Nero. By such expenditures, by exhibitions and plays during the meal, by the multitude of richly clothed servants, by providing dainties, for which the most extravagant prices were paid, but especially by the distribution of costly gifts to the guests, it may be understood how a banquet of Lucius Verus might cost $318,750.[419] (Compare Friedlander).

Hand in hand with this likewise went luxury in clothing. Wool and linen, from the first century A.D., had to give place to half-silk, silk, and materials with golden threads. Satin and velvet were unknown to antiquity. The greatest luxury was prictised by the women in pearls and precious stones, emeralds, opals and beryls, sardonyx, diamonds (the latter only in the rings). In the state apartments moved the throng of visitors in the morning,and at evening they were animated by the guests invited to the banquet, which prevented the display of too much furniture to prevent them from freely moving about in the halls, in contrast to our modern arrangements, where the reception and living rooms with their so-called "furnishings" are frequently more like a furniture storehouse.

As named by Friedlander[420] (see his work), the articles of luxury intended for the ornamentation may be comprised in the following.

a. Tables of marble or with citron tops on ivory legs.

b. Couches covered by Babylonian fabrics, the frame inlaid with tortoise-shell, gold and silver.

c. Ornamental vases of marble of different kinds, of Corinthian bronze and of murrha (spar ?). (Some of the latter were valued at $16,250 each).

d. Eginetan candelabra ($1375 each), candelabra of marble and bronze.

e. Sideboards with old silver work.

f. Statues and paintings of famous artists.

g. Ladles and drinking cups of rock crystal, as well as of monochrome and polychrome glass and the like.

For the rugs mentioned for covering the couches in the dining hall were paid as high as $35,000 each. Citron tables cost from $21,926 to $75,000 each. The exhibition of artistic works in silver dates back into the 2 nd century B.C. Silver bowls were already in use in Rome before the wars of Sulla, among them being those weighing 72.6 lbs. This luxury in silver was a sort of reserve, that could easily be pawned or carried away in case of necessity. Pompeius Paullinus carried with him about 8800 lbs. of silver.[421]

Note 421. Compare the silver found at Hildesheim, at Boscoreale, and at Bernay in Normandy -- then the rich collections of pottery, marble and bronze works, gold silver and enamels, tortoise-shell and amber objects, etc., in the Roman Museum, in the Museums of Naples and of Florence, in the palaces and villas of the great personages of modern Rome.

Tiberius had forbidden gold plate for private persons, or limited it to sacrifices, and Aurelian first permitted its common use.

423. Furniture.

The artistic treatment of the furniture, which likewise supplies information relating to the state and the elevation of art industry in general, may first be inferred from the marble tables in Figs. 584 to 587. "Materials and treatment demand reserved dignity, richness without caprices," says Burckhardt. Strong and elastically curved lions' paws form the supports, continued above the knee joint, the skin then being left in the form of enclosing acanthus leaves, from which pro-

projects the head of a lion, a panther or the upper part of a griffin, as the supporter of the top. These supports are usually combined in threes and are connected by transverse bands. (Figs. 584, 585). As a kind of sphynx with expanded wings is formed (House of the Faun in Pompeii) to receive the circular top of the table (Fig. 586); for rectangular tops, they are carved from two solid rectangular blocks, which are set under the ends and bear the top.(Fig. 587). In a perfectly beautiful manner was the circular table made of bronze in tripod form in Fig. 588 -- one of the ripest and most beautiful of the works of antique art industry. As an example of a basin of rosso antico in the form of a table with the architectural support surrounded by mermaids (Fig. 589); this is likewise a charming example of power in art industry. Allied to tables are the costly ornamental vases (Figs. 590, 591), made of rosso antico and of white marble, and the vase of white marble illustrated in Fig. 592 may well be regarded as an ornamental object of the highest rank.

424. Candelabra, Dining Couches, etc.

These works are all executed without any intermixture of any barbaric style. they are distinguished by a faithful adherence to tradition, "one of the chief differences between all antique and modern art; here art also constantly moves in its accustomed circles and solves even new problems in accordance with ever verified laws! -- How magnificently and in luxuriant strength grows the acanthus on the Vatican candelabrum (Fig. 593); how free and lifelike is treated the exterior, and still it stands there as a fixed architectural object, in contrast with its opposite piece from Naples (Fig. 594), that has something of the Biedermann style.(Late German Barocco).

But besides these objects in hard stone are the portable articles of wood and of metal, which for more than one reason are to be made especially prominent; the dining couches, chairs and double seats (bisellia); they show in what a lighter and more fanciful manner the ancients also mastered the refined minor arts.

The dining couches (lecti tricliniares) were chiefly constructed of wood, furnished with straps for the mattress, but most richly overlaid with bronze on the front and sides, that

again contained inlaid silver work. In the new collections in the Capitol at Rome is found a splendid example of such; another was found at Pompeii and is illustrated in the work mentioned below.[422]

Note 422. Mau. Fig. 191.

But few bronze chairs were found during the excavations in Pompeii, just as the bisellia (seats of double width and without arms) are not too common. Instead of inlays of metal, the furniture of ordinary wood is inlaid with costly woods, with ivory and tortoise-shell, the latter being so treated (in the time of Nero), that it looked like wood.[423]

Note 423. Compare Pliny. N. H. Book 16.

A particular branch of furnishing is formed by the bronze lamp stands (candlesticks) and the little lamps, whose feet and tops display a wealth of imagination and skill.(Figs. 595 to 597). The manner in which the spreading and firm base is produced by graceful forms is practically so logical and unusually beautiful, just like the supporting bell, that has freed itself in the happiest way from the severe architectural form of the capital. Burckhardt already says of the simple little lamp, "that it had the most beautiful form conceivable for its purpose, for it presents a vessel for the oil, an opening for the wick and a handle (Fig. 597), the latter being generally ornamented."

But even the simple metal vessels for use do not lack artistic forms, as shown by Figs. 598 to 600. The ovate shape of the container of the fluid with its foot, the recurved mouth and the charmingly curved handle with costly brooch, or the movable bails of buckets -- are in no period more beautifully or appropriately combined.

425. Silver Vessels and Ornamental Objects.

What is true for bronze articles may be accepted in a still greater degree for those of silver, according to Fig. 600. This silver vase came from Pompeii and it is characterized by excellent technical execution -- hammered and chased work together; it indeed belongs with the ancient show pieces classed under the letter e, since it still bears the Grecian character. It is now to be found in the Royal Antiquarium in Munich (No. 652 of the catalogue), where other silver objects from Pompeii

are preserved. (Desk 7).

A magnificent piece of antique goldsmith's work, but which was found near Armento on Italian soil, although in nowise specifically Roman work, is likewise preserved in the Royal Antiquarium -- the garland of honor of Kreithonios.(Fig. 601[424]).

Note 424. The possibility of the reproduction of the piece from a photograph, I owe to the courtesy of Privy Councillor von Christ in Munich.

"The basis is composed of oaken twigs richly filled with acorns, interwoven with convolvulus, asters, narcissus and myrtle flowers, whose stamens were filled with blue enamel and are partly so still. Above are two winged maidens and two cupids; at the centre, surrounded by peculiarly graceful palmatiums and acanthus scrolls is a winged female figure with a high headdress, basins and a sacrificial vase, now lacking; her mantle, as for the winged maiden, is made effectively prominent by granulating the plainly treated ground. The inscription on the base mentions a Kreithonios as the maker of this wonderwork of Grecian goldsmith's work of the 4 th century B.C." As frequently occurs after becoming wearied of civilization, antique art has here again adopted entirely naturalistic methods, and it has thus created something, that exhibits the closest observation of nature. It is here introduced in reference to that fact.

But the metallic vessels for cooking, bathing and the toilette are likewise objects of artistic treatment.

There were found in Pompeii kettles with trivets, cooking pots, buckets, scoops, stewpans, baking-pans, cake-forms, mixing vases, hot water vessels (anthepsa), charcoal basins, etc., which are preserved in the Museum at Naples. On an artistically treated bronze ring are hung the little flasks for oil, the cups for unguents, some scrapers (strigiles) as found, together with hand and stand mirrors of carefully polished metal. Gold and silver ornaments, similar to those already made known as Etruscan, or executed after Grecian models, are found in all public and private collections in the world.

426. Pottery and Glass Vessels.

With the ornamental articles of stone, bronze, silver and gold are contrasted those of burned clay and of glass. This

materials is in itself modest; but the ancients also knew how to give to these objects an artistically imposing form.

Red clay pottery without glaze or that with red glaze was not ornamental, still less the black with figures in relief or plain, or that finished with a greenish glaze (small lamps), likewise that covered with varied colors and gold, with painted figures or ornaments, they did not serve for daily use, but chiefly stood in temples and tombs.

Roman pottery invariably exhibits a better and nobler fofm than that of vessels blown in glass, even if it is otherwise inferior to Grecian. Yet this is compensated for glass articles by coloring. What are presented in this way by nearly countless fragments of the variegated millifiore (many-flowered ?) glass, by the varied opaque glass with the alternating colors of black, yellow and aquamarine from the Augustan period (Fig. 602), by the drinking vessels of greenish glass, (Fig. 603), by the white glass shot with gleaming violet bands, and by the dark green glass ornamented by blue spots from a later period. Even the vessels made entirely of the clear white glass , by peculiar treatment of the external surface, by reeding, bending or depressions, affords a play of lights, shades and shadows and reflections of especial charm.(Fig. 605). A masterpiece of the Roman glass-works flourishing on the Rhine is the glass cup wrought with a knife and drill from a thick glass body, and which bears the inscription; "drink during many years"(bibe multis annis). (Fig. 606). Around an inner glass body is formed a network of rods, on the bottom of which may be set the cup. It was found in a sarcophagus at Cologne on the Rhine, in which lay coins of the 3 rd century. King Louis I of Bavaria received it as a gift in gratitude for his aid in building the Cathedral of Cologne.

One of the finest products of antique glass-making is,and continues to be, the ashes urn of dark blue glass with a wh white layer over this, in which are cut reliefs representing a vintage in Fig. 607. It is certainly no article for ordinary use, and it is therefore best represented here. It was found in a tomb at Pompeii and is now placed in the Museum at Naples. A counterpiece of it is found in the British Museum

in London, well known under the name of the "Portland vase."

Likewise costly cabinet-work, based on the Grecian examples from the Crimea,[426] especially when we assume that the woodwork of dining couches, inlaid in silver and tortoise-shell, as well as the citron table tops resting on ivory supports, could not have been the sole articles of cabinet-work.

Note 426. Compare Semper. Vol. 2. p. 262.

427. Inscriptions.

Inscriptions have the last word, i.e., the letters of the inscriptions, "a decoration effective at a distance," which remained beautiful until in the latest period. Herein lies the essential difference in contrast with the Grecian, which at best were merely legible. "The Roman architect did not depend on the stonecutters and bronze-workers, but he treated as something indispensable, what so essentially pertained to the effect." Thus the ever inspired Burckhardt. The Arab architects stole this from the Roman. "Be amazed at my beauty", is the meaning of an Arab inscription in a frieze.

Fig. 608 reproduces an alphabet collected from an inscription in bronze letters at Holzhausen, a drawing of which Government Architect Jacobi on the Saalburg has placed at my service. The letters are characteristic, yet not as beautiful as are most of those deeply cut in stone during the Augustan period.

428. Palace Ships.

Floating ships -- war ships with princely furnishing or the state vessels for the reception of the great were not uncommon in the period of the Diadochides. Rome could likewise exhibit them. Ancient traditions tell of a state ship of Tiberius, sunken in Lake Nemi. The inhabitants of Genzano and Nemi believed in its existence, and indeed the hope of finding it never left the belief in peace. That not merely the learned world but also persons "powerful in capital" participated therein was not surprising; for the latter were able to do something. Whether impelled by the love for art or by the reserved thought of bringing to light treasures of great value, we shall not discuss -- but the act grows out of hope or inspiration.

The first attempt was made by Cardinal Prospero Colonna at

about the middle of the 15 th century, in which the great Leo Battista Alberti was engaged. A century later (1535) Francesco dei Marchi made collections by divers, and in 1827 investigations were made by Fusconi, that were not without results. By them is sometimes mentioned a ship of Trajan, then one of Tiberius or Caligula. (Compare also Nibby and Biondo da Forli).

In the year 1895, the Italian government took up the matter under the direction of Barnabei and the direct supervision of Borghi, to which the royal ministry also lent its assistance. The former existence of two vessels or palace ships was then determined. Under the sonorous title of "The great Ship or Floating Villa of Tiberius sunken in Lake Nemi." Maes made known these latest discoveries. One of the ships had dimensions of 198. × 60.5 ft.; beams from the other were found to be 84.3 ft. long. They are designated by A and B on the plan (Fig. 609), while D gives the location of the outlet tunnel (emissary). Woodwork, copper nails, a hinge band, a piece of terra cotta, pieces of glass mosaic, small marble slabs, with bronze cases for ornamenting the ends of beams by the heads of wolves and lions, or of Medusa, of very good work (Fig. 610, 611), were brought to light. The forms of the ships were thoughtfully outlined by floats on the surface of the lake. All these finds permit the conclusion that state ships existed and were anchored here. The architect R. Arcaini in milan was inspired to restore one of these, which Malfatti introduces with these words in his work mentioned below.[427] "For its interest alone, I reproduce a purely ideal and artistically fine restoration of the Ship of Caligula," which we give in Fig. 612[428] with the same reservation.

Note 427. Malfatti, V. Le Navi Romane del Lago di Nemi. Roma revista Maritima. 1896. -- Also, Lanciani, R. New Tales of Old Rome. p. 207. Rome. 1901.

Note 428. Reproduced from the same.

Chapter 18. Temples.

429. Forms.

Ancient Italian and Grecian methods are mixed with all Roman civilization and art, and they likewise make themselves felt in the buildings for the worship of the gods. Tuscan were the oldest temples of Rome, consecrated by Tuscan princely priests (lucumones) and built by Tuscan architects, -- the later being permeated by Grecian elements. Both in ground plan as well as in the architectural forms is this expressed. Under the increasing influence of Grecian culture and Grecian work gradually disappears in the last centuries of the republic the dependence upon the primitive religion.

The greater number of temples remaining exhibit an oblong rectangular form of plan, none of which now correspond to the Tuscan normal proportions of 6 to 5 (length to breadth); only the Temple of Hercules located on a declivity at Brescia, as well as the Temple of Concordia adjoining the walls of the Tabularium in Rome, were wider than long.

430. Location.

Crowning the heights of the upper city (Temple of Jupiter on the Capitol and on Mt. Cavo, Temple of Fortune in Palestrina) or adjoining the markets of the lower city (Temples on the Forums in Rome and Pompeii), standing singly or in groups on steep precipices washed by roaring waterfalls (Tivoli), on the wooded shores of a quiet and mysterious lake (Temple of Diana on Lake Nemi), were built the temples, rising sometimes from a stylobate in several steps extending around them or from a high substructure, at the end of which a stately flight of steps led into the interior of the temple, frequently adjoined by massive terraces (Palestrina, Baalbec).[429]

Note 429. Compare the view of Temple Fortuna Primagenia in Palestrina from the drawing of G. Rainaldi (1570 - 1655). in "Kritischen Verzeichniss der Sammlung architektonische Handzeichnungen der K. K. Hofbibliothek" by H. Egger. Part 1. Pl. 5 (here Fig. 613). Vienna. 1903.

431. Orientation.

Etruscan custom required the position of the temple from north to south (compare Art. 76), the Romans while praying turned toward the east; the temple facade must therefore look

toward the west, or the axis of the temple be directed from east to west.

This may have been the rule; but exceptions must have existed in most cases. As for the churches of our own time, the direction of the House of God is determined in accordance with local condition rather than by the sacred line, and this is particularly the case for closely limited sites in populous cities. Vitruvius (Book 4,5) also desires the orientation to be employed, "if no reason hinders and the arrangement is possible." If the temple lies on a river, it should face the bank of the river, and if it be built on a public street, its direction should be such, that those passing by may look in and pay their reverence, which best accords with the arrangement. A view of the location of the temples on the Roman Forum or of one on that in the plan in the city of Pompeii shows this satisfactorily.

Thus for example, the orientation of :--

Temple of Jupiter in Pompeii is southeast to northwest.

Temple of Apollo in Pompeii is southeast to northwest.

Temple on Forum Triangular in Pompeii is almost west to east.

Temple Isis in Pompeii is southwest to northeast.

Temple Esculapius in Pompeii is southwest to northeast.

Temple Antonine in Rome is southeast to northwest.

The axes of Temple Concordia and of Temple Vespasian in Rome are at right angles to that of Temple Antonine. Temple Castor and Pollux and Temple Saturn have the same direction as the Temple Antonine before mentioned; excepting that in this the niche with the statue of the deity is in the northwest, while it lay in the southeast in the others. The Temple Rome and Venus lies nearly north to south, and the niches of the statues adjoin each other (in the middle). Therefore the axes of the temples are at about 90 and 980 degrees apart and lie in the semicircle from 0° to 180°.

Since men were able to locate the cardo line accurately and there occurred no difficulty in laying off a right angle, the decuman -- the sacred line from east to west -- could then be readily drawn, i.e., an accurate orientation become possible.

The axes of the orientation were indeed likewise arranged

according to the position of the sun at sunrise on the day of the founding of the sanctuary; they might then vary in Italy about 65 degrees and still be always directed toward the sunrise.[430]

Note 430. Compare Guhl & Koner. Das Leben der Griechen und Römer etc. p. 371. Berlin. 1876.

432. Purpose.

A precinct consecrated by the priests was termed "fanum", which was dedicated with fixed ceremonies by the soothsayers (augurs), but the building for the service of the deity, the aedes sacra, was called the "templum." Like the Grecian temple, the latter served the god as a dwelling and was not intended to receive a multitude of believers. In it stood only the image of the deity, before which lay the sacred gifts offered. Before the temple was erected the altar, upon which were laid as sacrifices the products of agriculture and of cattle raising.

433. Shape.

Vitruvius (Book 4, 4) requires for the basal form of the temple a rectangle, whose width is to its length as 1 to 2, and the cell itself, including the wall containing the doorway, to be about one-fourth longer than its width, the remaining three-fourths falling to the vestibule, that extends to the antae, which must be as wide as the diameter of the columns. If the front of the temple be made over 20 ft., Vitruvius then requires two columns to be placed between the antae or angle columns, the intervals between which are to be closed by balustrades of marble or of carved woodwork.(Fig. 614). But if the width is taken at more than 40 ft., additional columns are to be inserted between them and in the same direction as above, as shown in Fig. 614.

Many temples accord in plan with the rules developed by Vitruvius; nearest come the Temple in Cori (Fig. 615), and among hexastyle buildings, Temple A of the three of S. Nicola in Carcere in Rome.(Fig. 616).

As a tetrastyle structure with antes instead of the half columns attached to the wall of the cell of the temple in Tivoli, appears the so-called Temple Esculapius at Spalato with its thick external walls, that have to resist the thrust of a tunnel vault (Fig. 617, b): with this is contrasted an-

another tetrastyle building with but single columns in return on the side of the Temple Augustus at Pola, that is characterized by unusually thin external walls.(Fig. 617,a). Without columns set before it and only with half columns against the antae of the wall containing the doorway appears the ground plan of the little Temple near the Bridge at Alcantara.(Fig. 618).

We accordingly see the facade of the temple treated as a plain cell, or as a prostyle structure with one, two, three or four columns in return at the sides. The longitudinal walls of the cell sometimes project beyond the wall containing the doorway; they sometimes form with it an angle, decorated by a half column or by antae.

With this form of temple allied to the Tuscan and really an ancient Italian type, men did not stop, but they soon adopted the Grecian in the realm of form;"for not for all the gods are the temples to be constructed according to the same ground principles, since in these this, and in the others that diversity in the performance of religious ceremonies occurs."(Vitruvius, Book 4,8). The form must be arranged according to principles, customs, and the nature of the case. Therefore he required for Jupiter-with-the-lightning, the sun-god (Helios) and the moon-goddess, temples internally uncovered (hypaethral), since we behold their acts in the free and open space; yet he says (Book 3,2) that no such temple existed in Rome, and that therefore temples dedicated to these deities ought to be there.

Vitruvius also makes the style dependent upon the peculiarities of the deities, when he assigns the Doric order for such as are characterized by valor (Mars, Hercules, Minerva); for others possessing a "tender nature" (Venus, Flora, nymphs), he desires the Corinthian to be employed.(Book 1,2).

Temples with magnificent interiors should according to custom have splendid external porticos; the access should not have a common and unimposing appearance; but naturally if all temples were built in the healthiest possible localities. Yet more than the porticos mentioned do the courts and outer porticos harmonize with the magnificence of the interior and increase the splendor of the whole, when they surround the temple

and their added effect increases the artistic enjoyment. They furnish proof that to the architects themselves the prospective charm was not indifferent. The Temple of Apollo in Pompeii (Fig. 619) and the Temple of the Sun in Palmyra with its double porticos, and likewise the great Temple in Baalbec still afford in their ruins a view, in one case simple, in another of the grandest design of fore-courts, porticos, and of the position of the Temple within them.

434. Ground Plan.

By their ground plans, we may distinguish between rectangular and circular temples or single and double temples. In the former, the cell generally forms an interior in a single aisle (compare Temple Hercules in Cori, the so-called Temple Fortuna Virilis, Temple Apollo in Pompeii, etc.); but we likewise find again the three-aisled plan of Grecian temples with the added colonnades parallel to the side walls, as for example, shown by the Temple Jupiter in Pompeii.(Fig. 616). The plan is subdivided into the open pronaos surrounded by columns and the enclosed cell, into the front and the rear parts. Concerning the depth of the former, no agreement exists in the monuments; from a shallow rectangular area it becomes square and generally extends to the width of the cell, but it is sometimes enlarged in peripteral plans to the columns surrounding the cell.(compare the plans of the tetrastyle temples in Tivoli, Rome, Cori (Fig. 615) and Temple Apollo in Pompeii. (Fig. 619)). Along the side and according to the depth of the rear portion, and including the angle columns are placed one, two or three columns, which number is increased to four for hexastyle temples.(Fig. 616; Temple Jupiter in Pompeii).

The longitudinal walls are sometimes extended beyond the transverse wall with the doorway; they sometimes form an angle with the latter, but they always end in the form of antes, which are made of the same diameter as the columns. In pseudoperipteral plans the ante changes into a three-quarter column. (Compare Tivoli, Temple Fortuna Virilis in Rome; Fig. 615).

According to the relation of the columns to the cell, as for the Grecian temples, we classify the temples as ante, prostyle and amphiprostyle, peripteral and pseudoperipteral,

dipteral and pseudodipteral structures, which in part still exist and are visible, or their former existence is proved by literary evidence,(Vitruvius, Book 3,1), among which the prostyle form was chiefly employed.

Note 431. Compare Part II, vol. 1, p. 75, of this Handbook.

The close or open spacing of the columns depended on the material and on the construction of the architrave.

435. Double Temple.

As an example of a double temple is to be mentioned that erected by Hadrian and dedicated to Roma and Venus, located on the Sacred Way in Rome.(Fig. 620). Two square cells with vestibules, whose semicircular apses join, are combined in oblong form and surrounded by columns, once forming a decastyle pseudoperipteral structure, which species was unknown to Vitruvius (Book 3,1) in Rome at his time. The Temple was built in 135 A.D.after plans designed by Hadrian, was rebuilt in 307 by Maxentius after a fire, and it was considered one of the most magnificent in ancient Rome. The portico surrounding it measured 546.45 ft. long and 328.0 ft. wide; the side next the street was supported by massive substructures. Pieces of the granite shafts of the columns are still scattered around; the walls of the cell were covered with costly varieties of marble.

Vitruvius (Book 4,8) further mentions "varying kinds," among which is that, where is transferred to the side, what is commonly on the end facade;" i.e., the placing of the principal entrance or of the portico with pediment on the latter. The Temple Concordia in Rome and the Three-celled Temple in Brescia are examples of this, since the steps, portico and pediment all lie at the longer side.(Figs. 621, 622). A peculiar solution for the access is shown by the Temple of the Sun in Palmyra; the entrance is there placed between two columns at the side, and a complete enclosure of the doorway by architrave with consoles and cap is placed before the shafts of the columns, extending to the height of the capitals.(Fig. 623). Likewise the prostyle with two rows of columns ("an arrangement combined from Tuscan and Grecian architecture") and the pseudoperipteral are accounted by Vitruvius aming the varying kinds.

436. Circular Temples.

436. Circular Temples.

Of round temples, Vitruvius (Book 4,8) mentions the monopteral -- without a cell -- and the peripteral, whose circular cell was surrounded by a colonnage.

If the Pantheon and some of the allied buildings in the vicinity of Rome were likewise temples, then a third species is to be added, in which the wall of the cell appears without any decoration by columns, only the principal entrance being emphasized by a portico of several columns. What was done directly and in the nature of a correct solution of the "variant kind" for the rectangular temple, for example at the Temple Concordia in Rome, -- the joining of the portico to the cell (removed from its natural position) -- was here a fact that defies all attempts to explain. None of the inferences are fully justified.

One monopteral structure on the Acropolis of Athens is termed a Temple of Augustus, preserved at least in fragments; a medal of Domitian (Fig. 624) gives a representation of such a temple agreeing with the description of Vitruvius; the mural paintings of Pompeii also furnish other information. In the Temple of Vesta at Tivoli and in the circular Temple on the Tiber in Rome, we still have fine and well preserved examples of the peripteral form; remains of other round temples or sacred circular buildings remain at Pozzuoli (the Serapeum, restored as monopteral by canina [432]), at Pompeii (the so-called Puteal or even a well-house at the Grecian Temple), at Rome in the court of S. Nicola de Cesarini and in the again uncovered Temple Vesta at the foot of the Palatine.(Figs. 625, 626 [433]). According to Servius (Ad. Aen. IX, 408), these round temples were dedicated to Vesta, Diana, Hercules and Mercury. At the round Temple in Baalbec is attempted a combination of the straight tetrastyle portico with the peripteral colonnade around the round temple -- an attempt that indeed could only be made during the late period, and which in its solution resembles the most Barocco creations of the late Renaissance. The wide spacing of the columns is made possible by the semicircular retunns of the architrave between each pair of columns. (Fig. 627 [434]).

Note 432. Canina. Sez. 3. Plate 42.

Note 433. Reproduced from Parker, J. G. The Archaeology of Rome. Part 6. New edit. Oxford. 1883.

Note 434. Compare I. Jahresbericht über die Ausgrabungen zu Baalbec. Plate 4. Berlin. 1902.

For the circular buildings assigned by Vitruvius to the disregarded third class, the Pantheon is to be mentioned as the finest example, the dignified and world famous work of Agrippa and of his architect Valerius of Ostia, or according to later investigations a work of Hadrian, which for near 2000 years has borne all the injuries from time and mankind. The entire architectural charm is here placed in the interior, the wall of the cell being merely animated in the richest manner by alternating semicircular and rectangular niches, "almost the only portion remaining (unchanged) from the building of Agrippa or of Hadrian."[435] A straight portico of three aisles and with eight columns in front is placed before the principal entrance, whose inharmonious junction with the circular structure cannot be frred from the criticist mentioned above.[436]

Note 435. Burckhardt. p. 19.

Note 436. Reproduced from Cent. d. Bauwesen. p.447. 1883.

Canina restored the "round temples" on Via Appia and Via Praenestina illustrated by him according to the Pantheon, and he designated them as temples. But they were really only heroas or tombs, like the so-called Tempio della tosse near Tivoli, while the similarly formed round buildings with plain exteriors and rich interiors near Baiae and elsewhere were parts of great bath structures, perhaps being laconica.

437. Pantheon at Rome.

Accodring to the inscription distinguished by its "proud brevity":-- "M. Agrippa, son of Lucius, consul for the third time, made it"-- i.e. in 27 B.C., and based on the statements of Cassius Dio[439] concerning Agrippa:-- "also built the Pantheon, so-called because it was erected in domed form like the heavenly vault,"-- it was believed on this evidence that one could not be mistaken. Nor about the further statement that it suffered by lightning in 22 A.D., and in 80 A.D. under the reign of Titus, it was destroyed by fire with the Serapeum, the Temple of Neptune and the Baths of Agrippa, and that Titus rebuilt it and the other buildings mentioned, at his own expense. 440

But overthrown to the ground afterwards in 110 A.D. by lightning (under Trajan), it was again restored by Hadrian, evidence of which is afforded by the bricks found on the building, stamped with the years 115 - 126, until it received a thorough restoration by Septimus Severus and Caracalla in 202, which is made known by a longer inscription on the upper band of the architrave of the vestibule:--"Pantheon, decayed by age, they restored with all care."

Note 438. Compare Burckhardt. p. 17. "Originally founded by Agrippa as the principal hall of his Baths, only later extended by him as a temple and furnished with a vestibule."

Further, Haussoulier, C. Le Pantheon d'Agrippe a Rome. Ency. d'Arch. 1882. p. 36. Afterwards, Stefano Piale began the proof that the Pantheon was nothing else than a laconicum (a sweating room) of the Baths of Agrippa, since such a circular structure neither has the character of a temple nor accords in form and design with any one of the known round temples. In form and size it also has more similarity to the great round hall of the Baths of Caracalla or to the circular buildings near Baiae. -- Borrmann, R. New Ausgrabungen in Rom. Cent. d. Bauwesen. 1883. p. 446.--- Notizie degli Scavi di Antichita etc. 1882. -- Reber, F. Ruinen Roms etc. 2 nd edit. p. 249. ;eipzig. 1878. "That the Pantheon was originally a temple is denied by Piale, Bunsen and Becker." -- Schöner, R. Das Römische Pantheon. Allg. Zeit. 1888. No. 320. "Not originally a hall of the Baths, but from the beginning intended for an independent and higher purpose." -- Geymüller, H. de. Documents Inedits sur les Thermes d' Agrippa. 1883. -- Nispi-Laudi, C. Marco Agrippa e i suoi Tempii. Le Therme ed il Pantheon. 1882. According to this the laconicum of the Baths indeed lay on the principal axis of the Pantheon, but it was not identical with it.(Compare Geymüller. p. 21. Fig. 3). The latter appears to have had its circular form entirely complete, even in the 16 th century. Two such laconica in the same design appear somewhat doubtful, and one should indeed adhere to the purpose of the Pantheon as a temple, primarily or yet during the construction.

Note 439. Born in 155, senator in 180, historian from 201 to 211; Roman History continued until 222. Book 53. Chap. 27.

Note 440. Compare Book 66, Chap. 24, of the same author.

So far the traditions and the inscriptions on the building. One might believe that these two things would dispense with any further investigation, and yet in time arose doubts of various kinds, that undermined the certainty of these statements.

The "very secred" building is divided into three parts; the rotunda, the portico, and the vestibule; hesitations relating to their original connection already made themselves felt in the 17 th century. Others came when men examined the edifice in respect to its construction and the material employed therefor, when it was doubted whether the inscription on the frieze of the portico applied to the circular structure. Piranesi already found stamps [441] on bricks, which belonged to the time of Agrippa, and Fea in his works [442] mentions bricks, that were taken from the building in the year 1804, and which bore the stamp of the era of Hadrian. Others were contributed by Lanciani [443] with similar marks.

Note 441. Compare Piranesi's Works. Plate 29.

Note 442. Concluzione per la integrita del Pantheon. Carlo Fea. p. 27. Rome. 1807.

Note 443. In Ruins and Excavations of Ancient Rome. p. 473-486. Boston & New York. 1897.

In the year 1885, Dressel raised other doubts, based on his researches on brick stamps (inscriptions on bricks), concerning the erection of the structure in the time of Agrippa. [444] His finds reject the era of Hadrian.

Note 444. See Boll. dell' Istituto. 1885. p. 69.

The Austrian architect Josef Dell appeared in the summer of 1890 with the fixed opinion that in the rotunda of the Pantheon, we have to do with a work of the time of Hadrian. To the same conclusion likewise came the French architect Chedanne, who made new measurements of the entire structure in 1891-92, but whose drawings have not yet been published. In the years 1892.3, the Italian government permitted investigations to be undertaken, whose results are given in the works of Luca Beltrami.

Note 445. Il Pantheon, the organic structure of the dome and of the supporting drum' the foundations of the rotunda, of the vestibule and of the portico, elevation of the edifice

before all additions by Adrian, "relazione delle indagini eseguite" of the Royal minister of Public Instruction of the yeyears 1892-1893, with illustrations by the architect Pier Olinto Armanini. Milan. 1898.

On this occasion, bricks found set in many places and doubtless belonging to the original structure, were removed and showed themselves as of Hadrian. The inscriptions of the stamps are given by Beltrami[445] and also by Hülsen.[446] The bricks were taken from the small discharging arch above the Corinthian columns, from the internal surface of the vault over the space between the niche of the high altar and the tomb of Victor Emanuel, and others from the spaces between the first and second shrines etc. All indicate the period from 110 to 125 A.D. An inscription attests the use of bipedal bricks.(Two ft. long). "C. Aouili Apridis ex praedi Caes. bipedale Dolia."

Note 446. In 4 th Jahrb. über neue Funde und Forschungen zu Topographie der Stadt Rom. 1892. p. 308-318. Rome. 1894.

If brick stamps of the year of the fire in 110 likewise occur, it may easily be possible, that in the imperial period men readily used bricks made in earlier years, since it was also not impossible, that Septimus Severus and Caracalla permitted the use of the products of the brick making of the time of Hadrian.

if the finds and investigations during the examinations mentioned be judged to be sufficient -- "Adler doubts this"[447] -- and it is believed, that even 1000 stamped bricks of the 2 nd century do not suffice as evidence, -- then may one strengthen the facts deduced therefrom and place about 100 years earlier the Pantheon, that milestone in the history of the art of vaulting, ascribing the existing structure to Hadrian instead of Agrippa.

Note 447. In Wochenschrift für Klass. Philologie. 754.

But should it then give us a Pantheon of Agrippa! What part of it may still be shown and how did it look? From the analogy of Grecian buildings, Michaelis conceives the Pantheon of Agrippa as a circular structure (Samothrace, Epidaurus), surrounded in the interior by a circle of columns, above their entablature being indeed the caryatids of Dionysos on pedestals, the whole covered by a conical wooden roof. But did it

have the same dimensions as the present one of "Hadrian"? Wooden beams 100 ft. long are mentioned at the erection of the Diribitorium; a wooden roof of the span of the present Pantheon might be constructed with such timbers without difficulty, and if the bronze pine cone of the Vatican, 11.5 ft. high and 6.56 ft. in diameter, were set as a finial, then so developed, it must have been not much smaller. But the skylight at the apex must have been omitted then, satisfied with high side windows.

But what now causes the grand internal effect of the Pantheon of Hadrian is the unity of the lighting, the fall of the light from above. But whoever desires this to remain clear to himself, if he visits the Pantheon at the time of the annually recurring ceremonies in memory of King Umberto, when the skylight opening is closed by white linen with a coat of arms painted thereon; he will do like St. Peter; "He went out and wept bitterly." Nothing of the usual charm is any longer to be found in the building, and with longing he awaits the moment, when the clear sunshine shall be unbroken and fill the interior. Therefore I also never believe, that the zenith skylight was ever glazed -- and this could also be done at that time, together with the bronze framework for it, judging from the roof trusses of the vestibule -- or closed or softened by any other material.

Then according to the "finds of the bricks", the construction of the rotunda is -- of Hadrian. But how does this accord with the belonging to this of other parts and with the inscription? That on the architrave band proves, that the vestibule certainly existed in the time of Septimus Severus and of Caracalla; but that on the frieze, according to the evidence of the brick stamps, must be set aside as not applicable here. It is indeed stated, that Hadrian always permitted the dedicatory inscription of the founder to remain on the structures restored by him; but this refers toan entirely new building, of which we do not even know, what similarity it had to its predecessor. Beltrami's report of the Italian investigations gives out the opinion that the existing portico is the remainder of a peripteral temple of Agrippa, which was saved from a fire. The idea is indeed pretty but nothing more. On the be-

basis of his excavation of the foundations, Beltrami finally decides:--

1. The area covered by the present rotunda was formerly occupied by another building, whose vestiges extend to 7.05 ft. below the present bottom.

2. The foundations of the side columns and of those extending parallel to them in the interior of the vestibule are of tamped concrete (systema a cassoni) and are later than the foundations (in pietrisco) of the rotunda.

3. The foundations of the front row of columns, that support the pediment of the portico, consist of travertine blocks; they appear to be the remains of a structure, that had no connection with the rotunda.

4. The portico (avoncorpo) has the same kind of foundation as the rotunda, so far as it is of brickwork.

5. The portico is therefore without doubt later than the rotunda, and its projecting portion cannot be regarded as the remains of a structure of the time of Agrippa.

Richter assumes that the structure of Hadrian had no portico, nor had that of Agrippa. His assumption is justified by the results of Beltrami, so far as it relates to the former; we know nothing whatever of the appearance of the other.

Chedanne is convinced that the form of the pediment of the Pantheon cannot possibly have been original, on account of the disproportionate height of the tympanum, whose cornice blocks must have been employed earlier elsewhere, according to his measurements. He concludes from this, that they indeed once belonged to the pediment of a portico of 10 columns for a building of Agrippa, which stood there. Two additional columns were discovered by the excavations, having intercolumniations similar to those now existing. Desgodetz says in his work,[248] also recognized by Dell as particularly deserving consideration:--"The opinion exists, that the body of the temple was first erected, and that the portico was added after that was completed. I have noticed that in the stairways of the portico, the side next the temple follows the circumference of the exterior of the temple, and that the front walls of the stairways merely touch the wall of the temple without any bonding, so that in many places light may be seen

through it; that may be seen on the plan, where the external circumference is continued. and in Place 4, this separation of the portico from the temple is marked B B." He refers to this again on page 5 of his work:-- "The interval marked B B (i.e., the vertical from the plinth to the main cornice of the rotunda) is that mentioned in the explanation of Place 1, where it was stated that from within the stairway may be seen light between the temple and the portico; this shows that the portico was added after the temple had been completed."

Note 448. In Les Edifices Antique de Rome, very carefully measured and drawn by the late M. Desgodetz. New edit. p. 3. Paris. 1779.

When I first ascended the dome of the Pantheon in the year 1866, I remember that to my companions, I made the same observation. The admission of daylight into the stairway along the line B B in Desgodetz may have been prevented in the mean- 449
time; but even from the exterior may still be seen (Fig. 629) that Desgodetz was right in his assertion, that the portico was only built after the completion of the rotunda.

The side pilasters, panels and architrave of the portico are set against the masonry and without any connection therewith; for the brick courses of the projection -- the bricks being 11.0, 11.4, 11.8, 12.2 and 13.4 inches long and 1.28 inches thick, with mortar joints 0.394 inch thick -- appear in the lower courses to range with similar courses in the rotunda (right side); this is no longer the case higher up, and at the height of the first band with fruits all ranging ceases. The marble cornice of the vestibule abuts against the circular wall in a crude way, and above it entirely ceases all correspondence of the courses of one building to the other, which must already have occurred on account of the arches in three rings and those of two rings in the upper story. If the projecting structure (Fig. 630) had been constructed at the same time as the externally visible discharging arches in the masonry of the rotunda, the arches must have started from the former. But they extend behind the masonry of the projection and portico, affording the technical proof, that the circular structure with the arches in its walls must have been erected previously, before the projecting structure was constructed.

The photograph shows this so clearly and plainly to every one unacquainted with the locality, that every doubt appears to be excluded. This part of the construction of the building is for myself decisive in this matter.

Note 449. From an earlier photograph.

Isabelle[450] likewise does not allow the projection and portico to date from the same time as the circular structure, and he also states that the bonding of the masonry between the two portions of the building is imperfect.

Note 450. In Les Edifices Circulaires et les Domes. Plate II and p. 35 et. seq. Paris. 1843.

Dell[451] states the case so accurately, that he shows how the projection is closely bonded with the circular structure as high as the capitals of the pilasters, (which is not uncertain to me for that height), and therefore both are contemporary. But only so far; for above this, he likewise finds the two structures separated by a continuous abutting joint, thus from the height of the pilaster capitals each was separately constructed, and one later than the other -- even if only by the time between building periods. Practical men here agree in their views and decide; -- that the lower part of the projection was constructed at the same time as the circular structure (foundations and some part of the vertical wall), a procedure again dropped in extending the construction further, and that the portico is a later addition.

Note 451. Zeits. f. Bild. Kunst. 4 th year (1893). p. 273-278.

The abandonment of the contemporary construction of the circular structure and the projection (not the portico) may have its justification by a purely technical reason, which I have previously mentioned, but did not then develop further, as something intelligible to practical men. An attack[452] on this statement makes its additional application excusable.

Note 452. In Preuss. Jahrb. Vol. 71. p. 211.

I had in mind the scaffolding and the possibility of constructing the great through discharging arches in the masonry of the rotunda, that are partly concealed behind the projection. As stated, the last possibility might be attained only by stopping at a certain height the projection of 39.5 ft.

The arched construction in the drum itself already prevents any bonding together of the walls of the two structures -- the rotunda and the projection -- ; thus by the chosen method of construction an opposition to sound building is not to be denied. By stopping the masonry of the projection at several ft. above the plinth, the scaffolding for the rotunda was made easier, since it could be extended around it uniformly without any interruption. After the removal of the scaffolding of the rotunda, so far as required by the projection, the latter having a richer architectural treatment could be erected with special scaffolds in several stories. Thus was avoided all unnecessary scaffolding and all departure from sound construction. A combined plan existed for the rotunda and the projection, in accordance with which the execution proceeded, and the evidence of this may likewise be observed in the building itself.

The massive cornices of white marble, which rise above the marble pilasters of the projection, are for me original parts of its facade -- and Dell appears likewise to be of the same opinion --; they are certainly not parts added later, as proved by their form, their dimensions, and the mode of connection. They belong to the original design of the projection, and like the great niches and the design of the entrance doorway, they are children of one father. But the higher console cornice of the projection, which is yet organically connected with that of the same kind on the rotunda, belongs to the first design; these are likewise not the products of a later time. The same is also the case for the cornice extending along the front of the projection, two-thirds of which still remains in sight, now being concealed by the pediment of the portico. With this are likewise the two masonry ends of the pediment cornice, the angles of which yet remain, only the apex being interrupted. Two main cornices at a short distance above each other, the lower more imposing in appearance than the upper, really on account of direct connection with the supports beneath and the upper one combined with a pediment! Are these foreign and previously unknown elements in Roman architecture? No! Models are indeed wanting on Italian soil; but in the Grecian colonies and in Arabian Petra do they exist. The beautiful Temple Minerva at Thebessa (Africa; see Fig. 665) and likewise the Temple-Tombs in Petra (see Fig. 828) partly date from the time of

Hadrian and may serve as evidence therefor. Are they products of a provincial art or scions of an architectural style of the capital city? I may believe the latter. The temple architecture in Thebessa with its small pilasters between the two cornices and the ornamental panels have something in common; the small pilasters between the main and pediment cornices on the tomb facades of Petra are remarkable examples of the same architectural feeling, which is likewise found with fortunate execution on Etruscan-Roman buildings. (Compare the City Gate in Perugia).

What conception of a reconstruction of the entire facade of the Pantheon can be deduced on the basis of the materials existing in the structure and the connected temple facade? This idea can be attempted, and it is represented in Fig. 631, into which enters everything told by the building. Nothing is changed in the design of the pilasters and niches, in their dimensions and details, or in the arrangement of the cornices and their magnitudes. Only the entrance is a product of the imagination, based on the plan and treatment of the internal niches of the building and the arrangement of the entrance story of the beautiful temple facade of the "Hazne" at Petra (Fig. 828), that Domascewski has decided to belong to the era of Hadrian. The representation perhaps gives a better relation between the heavy architecture of the rotunda and the projection, crowned by a pediment. That according to the latter, a building without portico was first desired, must be certain, and Dell and Richter are also of the same opinion, excepting with this difference, that the former believes that a complete facade without portico never existed. But the evidence for this on the building is not to be contested, and the facade must have existed, even if not yet complete in all its parts, before it was decided on the addition of a great entrance portico; this was executed while retaining the architectural ornamentation at the sides of the projection (pilasters, wall treatment, architrave, frieze and cornice), its niches, but with the remorseless destruction of the flat upper pediment and of the principal entrance.

And now for the third part of the building, the portico. What is seen today is a portico with little organic connection

to the projection, consisting of 8 Corinthian columns of granite with beautifully treated bell capitals of white marble, which receive an architrave and frieze, both wrought from a single block of marble, above these being a modillion cornice. From this cornice rises a pediment, whose tympanum lies in the same plane with the surface of the frieze, therefore not being set behind that in accordance with the Grecian model, and in order to provide the necessary space for the free statues set before it. Even if the projection of the main cornice be not small, the space from its front edge to the surface of the tympanum is not large enough for receiving free statues, if one would not wish them to project to the extreme edge of the cornice. If figures were here, only those represented in relief could be used, such as are shown by the Etruscan temples and those in Africa. The holes in the tympanum wall were indicated as necessary for fastening bronze reliefs (on the Erectheum in Athens, the small marble figures were fastened on the frieze -- why therefore bronze ones for the same purpose?). The tympanum is rather high in proportion to its length, it has a heavy effect, and it could scarcely have been suitable in its form for the reception of figure ornamentation. It too large in proportion to the other decoration, a fault into which the ancients never fell. That the angle of inclination of the pediment of the portico is not the same as that on the projection may be mentioned. Although one may verify this difference by observation of the building or on good photographs, yet it is not usually regarded in publications. Likewise the fact, that not all the granite columns of the portico have the same color may be considered; it can only furnish evidence of the later erection of the portico. At what time granite columns were first introduced into Rome may remain undecided here; in any case this occurred before the building of the portico of the Pantheon. The frieze and architrave of the facade bear the two inscriptions mentioned, the uppermost of which was inlaid with metal a few years since without exactly improving its effect.

The massive marble cornices of the ends of the projection are also extended in unchanged form above the columns of the portico, and they harmonized with the height of the portico.

(Fig. 683). Its high pediment must perhaps aid in concealing the upper portion of the plain wall of the projection. To have retained the original form over the portico, which projects 46.0 ft., and to have permitted a ridge 85.4 ft. long to intersect the circular structure, would have oppressed that, and it would have produced an unbearable emphasizing of a subordinate part of the building over the principal structure, when one must have originally descended five steps from the limited area enclosed by porticos, in order to obtain a view of the whole. Little of the circular building would have been seen!

The portico was covered by tunnel vaults, above which rose the bronze framework of the roof, from which Pope Urban VIII had 80 cannons made in the year 1625 for the Castle S. Angelo. It is untrue that the tabernacle in S. Peter was made therefrom. The statement is further untrue, that the bronze doors of the rotunda are ancient; the ancient doors were recast under Pius IV.[454]

Note 454. Compare Lanciani. Ruins and Excavations of Ancient Rome. p. 484 et seq. Boston & New York. 1897.

Thus the portico of the pantheon presents itself as an addition to the main structure during the time between the reigns of Hadrian and of Septimus Severus or of Caracalla (117-212), not organically joined to the rotunda and indeed only resulting from the practical necessity of affording to visitors of the sanctuary the possibility of not being compelled to pass on leaving without protection and directly into the open air, or it served as a gathering place before entering the sanctuary. Partly built with portions from a better period, the "Agrippa inscription" can only be explained, if we regard it as an ornament with which a name was connected, whose bearer was honored by men, and which was intimately connected with the adjacent buildings.

The restoration under Septimus Severus, made known by the inscription on the architrave of the portico, indeed chiefly refers only to the interior, the marble lining, which is now known by the accurate and reliable drawings of Desgodetz, and which still existed in the 18 th century, but which had to give place in 1847 to a stucco ornamentation in a different style. Neglected in the middle ages, robbed during the period

of the Renaissance and injured by additions, the rotunda now stands before us, bared or its external covering and showing its structural skeleton.

We are on a more assured basis for the structural parts of the exterior and the interior, the walls of the drum and the great dome resting thereon. In Art. 215, the construction of the drum and of the dome were treated in a general way, and it was there stated, that structural peculiarities made known by Piranesi and afterwards by Canina were based on uncertain grounds or were to be only exceptionally accepted. It was there said, that the wall of the drum consisted of two annular walls intersected by 16 connecting piers. Or with Adler, the matter might be so regarded as to assume 8 hollow piers on which rests the dome, and which are joined by a solid ring of masonry, that does not change the facts. These 8 hollow piers,[455] as previously mentioned in the first edition of this volume, (p. 184) are constructed by arches extending through the entire thickness of the wall and are united into a whole,-- a view already expressed by Piranesi and after him by Isabelle, (Plate 14) and which Dell has recently (1893) adopted.[456] But the connection of the 8 piers is not uniform; we rather have to do with different kinds. Four of the spaces between the piers are trapezoidal in plan; two are portions of circles; that now utilized as an altar apse is semicircular, and the one serving for entrance is open on two sides and is covered by a tunnel vault resting on two parallel side walls. The similar through arches spanning the spaces therefore only refer to the four spaces of trapezoidal form lying on the diagonal axes, while those on the transverse axis must be of different form. Isabelle, in his practically impossible section,[457] shows through arches for the latter also, which produces a depression of the niche vault against the arch, and which he had better not have drawn; for the crown of the niche vault there shows no strength. It is similar with the through arch at the apse. (Concha). The case is otherwise at the entrance, where the springingsof the arch are not radial, but are made parallel to the middle axis. Thus--all uniformity is here excluded; what Dell worked out can only apply to the 4 niche vaults lying on the diagonal axes, and it can only be nothing less

than "approximately certain", that the arches of the 4 other niches extend through. For the niches with the radial springings, as in the case for the arched openings of the Amphitheatres in Nimes and Arles, at the Tomb-Church of S. Costanza in Rome, or on the Baptistery of Nocera, the vault must certainly take a conical form (Fig. 634), in which either the imposts or the crown must be inclined or made horizontal. At the buildings mentioned at Nimes, Arles, Rome and Nocera, the imposts are made horizontal, since they are architecturally emphasized; the case is otherwise at the Pantheon, where a horizontal crown was desired for structural reasons, and therefore the imposts were inclined (Fig. 634), that did not architecturally require to be emphasized as inclined. Dell conceives stereometrically this kind of construction, so that he states:--"The tunnel vaults of the niches have the form of oblique circular cones, whose crowns are horizontal, but whose axes rise towards the interior",-- which may be true for the 4 niche arches, but not for the four others. But the basal idea of the structure is scarcely changed thereby. How the brick arches in 2 or 3 rings are executed is best shown by Figs. 629 and 630, which were made from good photographic views. The arrangement and forms of the discharging arches on the exterior likewise appear in the interior. Between the great semicircular niche arches extend smaller ones, and the removal of the plastering from the masonry of the drum by Beltrami in the year 1893 completely supports the earlier statements. The doubled discharging arches above the columns and within the niches -- really only a caprice -- are likewise fully established.(Fig. 637).

There was already stated by Isabelle and established anew, the existence of the perforated through walls beneath the joints of rupture of the great niche arches, which the columns of the niches aided in better spanning the interval and likewise stiffened the weaker parts of the external wall below the discharging arches. Everything substantial and well considered! But with these through ties (Figs. 638, 639), there also disappears every special and ornamentally treated free support within the niche arches-- figure, pier or column. What could not be known earlier and was revealed by the investigations of Beltrami in 1893, is the repetition of the uppermost great dis-

discharging arches also in the masonry. Such are sketched on a drawing by Sangallo.(Fig. 640). Desgodetz, who saw the interior without plastering, unfortunately presents no conclusions thereon, since he placed little weight on the consthuction; He merely says [458] (p. 8):-- "On the vault, there is nothing but bricks, the covering of plaster has fallen; and there is reason to believe that the squares (coffers ?) were filled with rosettes of gilded bronze - - - ." He proves the construction of the dome of brickwork; but we learn nothing of the details of construction. The great discharging arches are again continued above three smaller ones lying in the spherical surface. The latter, so far as visible from the rear, i.e., from the vacant spaces, were already drawn by Isabelle [459] and (Palte 14, bis), also Choisy (Fig. 414 [460], and Piranesi also is assured, that the great brick discharging arches, which may be seen from the exterior beneath the great principal cornice, likewise appear inside next the vault. Sangallo and Piranesi therefore are correct in their statements.(Compare the three illustrations in Figs. 638, 642, that show the plastering removed in the interior of the dome). Armanini in Beltrami [461] permits the great discharging arches to rise vertically in the interior, but draws the vestiges of the arch in the second reveal of the coffers of the second row from below and at the same time on the rib at the middle of the height of the first row of coffers. If the arch were carried up vertically, then in one case an overhang of 0.65 to 0.98 ft. and of 4.93 ft. in depth in another, must be made in order to reach the arch (Fig. 643). By the cutting mentioned, which only related to the plastering, the evidence was obtained, that the arches were executed with their upper parts overhanging and following the form of the dome, while they rise exactly concentric with the ring wall. Beltrami states his results [462] (p. 71) as follows:--

1. The structure of the dome consists of ribs of brickwork, that are connected together by horizontal rings of the same material, with an inclination of the courses toward the centre.

2. In the horizontal rings bipedal bricks recur at distances of 4.93 ft.

3. At the springing of the dome are found through arches

of the 6 niches, corresponding to the entrance and choir niches, just as they appear on the exterior.

4. At the imposts of these great arches are built 3 small arches with connections to the lower colonnade within the niches.

We further learn from Isabelle, that Leclerc was the only architect, who has accurately measured the arrangement of the coffers, and he tells us that the recessed portions of the coffers are all made of concrete, while the side surfaces were always executed in brickwork. I think that the execution of the coffers was the same as for those of the Basilica of Maxentius and that the arrangement of the ribs and rings as far as the vertex was similar to those of the dome of the Tomb=Temple of Tossia near Tivoli, which I have previously considered.

The skylight of the dome still shows remains of the former cowering of gilded bronze, indicated already by the drawing of Sangallo previously mentioned (1515), that De Lorme likewise drew (1532), which is accurately represented with its ornamental details and fastening arragements by Desgodetz, (1682), and which was also published in the same way by Ruggeri and Isabelle.(Fig. 644). The effect of the interior is given by a drawing of Isabelle (Fig. 645 [463])one of the best representations known to me and architecturally more effective than a photograph would be. It shows the condition and the internal decoration at the time of Septimus Severus, as it is ensured by Desgodetz' illustrations.

Note 463. Reproduced from Isabelle, M.E. Les Edifices Circulaires et les Domes. Paris. 1843 - 1855.

Dell desires to deduce from various irregularities in the construction, that for this building the architectural portion of the interior was "certainly not constructed anew, but had already existed previously." It other Roman structures, as well as Grecian works of the first rank and the best works of the Renaissance, not taking into account the middle ages, in which it did not occur, be observed and considered, one will then be compelled to adopt the same statement for all of these with scarcely an exception. But this had best not be done. The execution of a composition, such as is shown by the niches of the rotunda, remains beautiful and dignified, even

if a sculptor has once measured or cut the width of the capital different from the width of the shaft, as shown in Fig. 646 on the right angle pilaster. Yet other defects and faults in other very important buildings of all periods and styles may be mentioned, even when they had but one master and their parts belong to the same architectural period. What the architect of Septimus Severus made of the interior is known to us by Desgodetz' drawings; what Posi destroyed, we have still before our eyes. (See Figs. II and IV of the comparisons in Figs. 647, 648). How Adler understood this is given by Fig. III, and Fig. I shows how Dell conceived the interior at the time of Hadrian. The interesting restoration (III) is no longer to be accepted since the discovery of the through masonry connections in the niches, and in I are disturbing the metal railings above the lower main story, which did not extend to right and left of the apse and of the entrance archway, therefore appearing useless otherwise, and what the grilles in the arches should enclose is difficult to conceive. The proposals of Adler and of Dell have in common, that both permit the great arches over the niches to fully appear, whereby the mighty coffered dome is contracted with a correspondingly stronger and largely subdivided substructure, than was the case with the arrangement of small pilasters out of all proportion, and the niches for the lining by Septimus Severus, executed in the upper zone. This conception of Adler and of Dell perhaps approximates to our modern design rather more closely. The refined Burckhardt expresses himself in regard to the interior as follows:-- "The doorway niche and the altar niche opposite to it have their round vaults intersect the great circle in an ugly manner; there results a necessary double curvature, which the eye does not suffer, as soon as it is observed." 464 (p. 19). He terms it a "discord", which must be felt the more, since instead of but twice, it is now repeated eight times in the interior.

Men have avoided this discord in other central structures by making the interior polygonal (with eight or ten sides), as in Temple Minerva Medica or in some interiors of the Baths of Caracalla. In order to suppress or lessen the bad effect of the lines of double curvature, for example, on the Tomb

Tossia near Tivoli, the openings in the walls are covered by flat arches, and in the great rotunda of the Baths of Caracalla compartment vaults are arranged above the round-arched openings. The period of Constantine first disregarded such discords in the play of lines, as shown by the round arches lying in the curvature above the doubled columns of the Tomb of S. Costanza near S. Agnese near Rome.

The architects of the Pantheon are reproached with having employed too great a mass in the substructure of the rotunda! Now each of the 8 piers has a ground area of 592 sq. ft. in round numbers, without deducting the hollow area in the interior. The mediaeval master of the Cathedral of Florence placed 4 supports beneath the dome projected by him, each of which has a ground area of 1603 sq. ft. This later born master is therefore no bolder, even if the comparative heights, loads and effects of forces differed in the great structures mentioned.(Figs. 644, 649).

It cannot be without technical interest to compare the later and greatest domed buildings on Italian soil with the earliest. Ancient Rome exhibits in its own structures the greatest diameter with the most modest proportions in height, of all that are known. Nearly equal to it and but slightly reduced, the domes of the Cathedral of Florence and of S. Peter in modern Rome have materially greater development in height. Up to the cross, the dome of S. Peter is three times as high as the Pantheon, the Florentine dome being 2 1/2 times.(Fig. 649). In spite of this vast difference in height, I ask in which of the three structures, considering the dome alone, is the effect of the interior and the impression upon the observer the mightiest? However great and lasting the effect of the interior of S. Peter's is after repeated visits, and while one always receives new suggestions and revelations, "there predominates before everything in the Pantheon the unity and beauty of the skylight, which so wonderfully fills the colossal circular building with its rays and their reflections."[465]

Note 465. Burckhardt. p. 18.

A peculiar connection of oblong side cells with the circular principal cell and the exedra-like vestibule is shown by

the Temple of Romulus, son of Maxentius, beside the Basilica of the latter. (Compare for the plan, the plan of the Forum in Fig. 694, and for the elevation Fig. 650, after a drawing of Panvinius (1560).

438. Polygonal Ground Plan.

A better solution for the junction of the portico with the circular cell is obtained, if the external wall of the latter be made polygonal and the round form is limited to the interior, like the case of the Tomb-Temple of Diocletian at Spalato.

439. Elevation; Exterior.

The temples sometimes rise above a substructure in several steps after Grecian models, and Vitruvius (Book 3, 4) prefers an unequal number of steps of equal size extending around, having 5/6 to 3/4 foot rise and 1 1/2 to 2 feet tread. In opposition to the Grecian idea, he requires actually usable steps. But in most cases steps for use were only placed at the entrance end, a substructure extending along on the other three sides, which consisted of plinth, base, die, cap and pedestal for the columns. Then side walls of the same height as the substructure and profiled like it, either enclose the steps for the entire pediment front, or these extend only for the width of the middle intercolumniation. Pedestals sometimes interrupt the steps, or they are inserted between the plinths of the columns. (Compare the various arrangements in plan in Figs. 614-617, 651).

On the stylobate or this triply divided substructure stood the sacred temple, the cell with its surrounding columns, which supported entablature, ceiling and roof. The selected order governed the formal treatment and the proportions of the Temple. Tuscan, Ionic and Corinthian occur; a temple with the Composite order is unknown; the Corinthian was especially preferred. Frieze and architrave on the pediment end are frequently combined into a great inscription tablet. (Often a later change). The tympanum, the apex and ends of the pediment were emphasized by figure ornamentation in many cases. Fig. 652 represents a Roman temple of the deity, the Temple of Vespasian at Rome with its entrance steps, altar and pediment decorations, according to a restoration by A. Normand.

Note 466. Reproduced from Encyc. d. Arch. 1883. Pl. 845.

440. Temple with Steps and Podium.

Temples with steps and those with a podium therefore alternate with each other in Roman architecture; but the latter show, as already stated, another treatment besides that previously mentioned, i.e., a vertical subdivision of the podium by pilasters or projections arranged to correspond with the columns, as have also been found by excavations recently at the Temple of Vesta on the Forum, and as they are represented on the temple relief in the Uffizi at Florence. Likewise a pedestal returned with a regularly continuous entablature above the columns.(Figs. 399, 400). We find the same arrangement likewise at the Temple in Kfar-Soudane.(Africa [467]).

Note 467. See Monuments Historiques de la Tunisie. Pl. 31. Paris. 1898.

The podium received a different meaning and treatment if it was to serve for a definite purpose. At the Temple in Henchir-Kasbat (Figs. 653, 654), a Corinthian hexastyle structure, 84.0 × 52.5 ft, of ashlar masonry of large limestone blocks set without mortar and carefully joined by metal cramps, the substructure is entirely plain. It is constructed with an internal room accessible at the rear by 2 doors 6.56 ft. wide, receives light through grated windows and was indeed intended for the safekeeping of valuable articles. The Temple was dedicated under Caracalla in 211 A.D.

From the period at about the end of the 2 nd century dates the Temple at Henchir-Debbik, that has in the front part of the podium a crypt accessible from the exterior, beneath which (Fig. 655, section) is also a vaulted cistern to receive the rain water flowing from the temple. Imperial Rome can likewise show an allied arrangement within the podium of the Temple of Castor and Pollux. It was dedicated in 484 B.C.; the part now standing indeed belongs to a restoration of the temple in the time of Hadrian or of Trajan, or according to Petersen, to the third structure of Tiberius. The approximately square cell was surrounded by columns (Fig. 656), that had a height of 47.6 ft. and a diameter of 4.93 ft. with capitals of very beautiful workmanship. The substructure (Fig. 657) was resolved into an arrangement of small piers, according

according with the position of the columns. Between the small piers were arranged doors, that opened into the chambers (Tabernae) lying behind them.[468]

Note 468. Compare Richter, O. Der Castortempel am Forum Romanum. Jahrb. d. Kais. Deutsch Arch. Inst. Röm. Abt. Vol. 13. (1898). Berlin. 1899.

The rooms (tabernae) were closed by bronze doors and further had external grilles (Fig. 657). They occurred along both the longer sides and served for the safekeeping of the imperial funds, but were used for the same purpose by private persons.

The flight of steps might serve for other uses; for the publication of imperial decrees, or it was a place for those addressing the people (Fig. 657); it became a rostrum for orators. Two narrow flights of steps led to the latter, and only from it did one pass up the great flight of steps to the area before the temple, before which may have stood the statues of the two Dioscurii with their great horses. The flight of steps well fulfils its purpose according to modern ideas, as it is restored; but it takes from the temple the purely monumental, simple and grand entrance and weakens its effect as a whole. More definite information is given us by the still preserved temples at Nimes, Vienne, Pola, and many others (Figs. 658-660), which are built of white limestone and belong to the ornament loving Augustan period and to the richest Corinthian order.

The frieze is always decorated by scrolled vines and flowers, thus in Nimes and the Temple of Augustus at Pola (Fig. 661[469]). The inclination of the pediment is always less steep, as on the Temple at Assizi (Fig. 651) and on those in southern France. Likewise on the Temples of Mars Ultor and of Mater Magna at Rome represented on the reliefs (Figs. 662, 663), which bear figure ornamentation in the tympanums, that has a good effect with the moderate altitude of the triangle and does not crush the substructure. To prove the correctness of the statement, let one sketch in the corresponding figure ornamentation in the high pediment of the Pantheon and observe the result. Not at the climax of good taste! It should not be overlooked on the representation in relief of the temples mentioned, that the columns are made too high. the

acroterias are also excessive.

Note 469. From a photograph of Wilha in Vienna.

The proportions were differently treated in the African temples, where the entablatures all have too high cornices and architraves, instead of the fixed dimensions of the architrave, frieze and cornice of the buildings in the city of Rome.(Compare the Temple on the Capitol in Dougga.(Fig. 664)). Only the Temple at Dougga was built of fine-grained limestone under Marcus Aurelius and Lucius Verus (166 - 169 A.D.); the masonry of its cell consists of stone timber work and is covered by plastering. The frieze bears the dedicatory inscription and is made so high on that account, which is always more sound architecturally, than is the combination of architrave and frieze, as for example on the Temple of Vespasian at Rome. (Fig. 442). The tympanum is adorned by a relief, a half naked figure, which is raised by a mighty eagle with outspread wings, doubtless an imperial apotheosis. The Temple is technically indicated as provincial work by the execution of the pilasters in mortar only and the cornice in stucco above them.

Note 470. Reproduced from Encyc. d'Arch. 1883. Pl. 845.

Yet more massively are formed the columns of the Temple of Minerva at Tebessa (Figs. 665, 666), at the same time being peculiar in form, while the architrave is characterized as being composed of pillars with panel slabs between them. A heavy moulding crowns it at top; there follows a low plinth and above this is repeated with a different ornamentation the same treatment as on the architrave -- but here as the frieze. Above it the main cornice with consoles must have formed the termination, but it no longer exists. The entablature is not crude in detail, but in general it must have had a heavy effect above the columns.

441. Temple Groups. Par. 441 omitted here

442 The walls of the cell, "their thickness suited to the magnitude of the temple" (Vitruvius, Book 4,4), built of small quarried stones, bricks, or uniform ashlars of moderate size, are left entirely smooth on their external surfaces, like those of Grecian temples, but with the difference, that in the latter the joints are not emphasized, while in the Roman the "picturesque play of lines" (Vitruvius, Book 4,4) is very effectively

characterized. The Grecian system recurs frequently in the arrangement of the courses. For example, compare the form and succession of the coursed stones of the Erectheum at Athens [471] with those of the Temple at Terracina in Fig. 670.

Note 471. See Part II, Vol. 1 of this "Handbook", 2 nd edit. p. 164.

On the plinth follows the plain course set on edge as on the Parthenon, Theseum and on Temple of Poseidon at Paestum. Then comes a decorated band, indeed after Hellenic models in Asia Minor, over that being the uniform coursing, the stones being separated by rectangular grooves at the bed and end joints. At other times we find the wall surfaces subdivided by pilasters, half columns and niches, as well as penetrated by windows and doors. (Compare Temple in Cori, Temple Fortuna Virilis in Rome, the Round Temple in Baalbec, Temple of Vesta in Tivoli and Temple of Jupiter in Gerasa).

These forms of the subdivision of the walls and of openings apply to both the rectangular temple cells and also to the circular. (Compare the circular temples in Rome, Tivoli and Baalbec).

Data is wanting for the subdivision of the walls of the great rotundas, since all of them have lost their external covering. [472]

Note 472. In the work of Lafrerio, A. Roma Antiqua et Nova, etc. 1846-1868. There is given on Plate 38 the exterior of the Pantheon as divided in three stories, the lowest one exhibiting a plain covering of ashlars, while the two upper ones show a subdivision of the wall surface by pilasters.

Vitruvius (Book 4,8) gives definite rules for the construction of the monopteral (compare as an example that already mentioned on the Acropolis at Athens and dedicated to Augustus) and peripteral temples, which may easily be deduced from Fig. 671. He requires the height of the middle of the roof to be such, "that the height of the dome, exclusive of the flower, should be one half the diameter of the entire building." But this rule only applies to the monopteral temples, for the peripteral structure would not occur without stepped roofs, i.e., withiut separate roofs for the portico and for the cell. Likewise must one disregard the spherical form of the latter and refer for the conical form to the model of the relief of a round temple in the Uffizi (Fig. 672) or the free hand drawing

of Panvinius [473] of one, or to still existing though not entirely certain example of the Temple-Tobb of Diocletian, [474] whose apex may yet be as high as Vitruvius desires it for the domical roof. (Fig. 673).

473. Reproduced from Parker, J. G. The Archaeology of Rome. New edit. of Part 6 etc. Oxford. 1883.

Note 474. The existing conical roof on the Temple-Tomb in Spalato is doubtful, as already steted and sketched, and a form of the roof is preferable in accordance with the great examples, where the ceiling and roof conicide, substituting the skylight as on the Pantheon. Yet for the relatively small diameter of the domed interior, the opening must have been glazed in order to prevent the entrance of rain and snow in the frequently quite raw and winter climate there.

For the peristyle, he wishes the space between the columns of the portico to be enclosed by grilles; we have assured evidence of the former existence of these grilles in round temples. The medal of Julia Domna (Fig. 674) shows such on the Temple of Vesta, and likewise the relief in the Uffizi (Fig. 672); but the best data is given by the forms of the columns of the Temple of Vesta, located at the foot of the Palatine. On their external surfaces and on opposite sides are formed smooth strips, which facilitate proper junction and firm fastening of the bronze grilles, and the arrangements for fixing them are still preserved.(Fig. 675 [475]

Note 475. Also compare: -- Tutti i tronchi di colonne conservano i fori per le grappe dei cancelli, e perfino ie impiombature di dette grappe in Notizie degli Scavi di Antichita. Dec. 1883. p. 475, 476.

Schulze has been opposed to the question of the subdivision of the substructure, "since the placing of grilles in the intercolumniations would cause difficulties." [476] One should consider, however, that no hesitations or difficulties of any kind would arise from placing the external surface of the podium wall in the plane of the front of the dado band or in that passing through the centres of the columns, for these would be obviated.

Note 476. Compare Hülsen, Ch. Ausgrabungen auf dem Forum Romanum in 1898-1902. Rome. 1902. Mitt. d. Kais. Deutsch Arch. Inst. Röm. Abt. Vol. 17. Heft 1. p. 80 et seq.

Schulze and Auer[477] agree in giving the fastening arrangements at the rear edge of the band; Tognetti prefers to have seen them "lying tolerably far behind it." That the "holes for for fixing the grilles were cut on the diameters of the shafts of the columns" as Hülsen states, no one has decided except himself. The bands must have one aim and purpose, and this is at once made clear by the statements of Schulze and Auer; in the existence of the fastening holes in the rear edge of the band. These received the transverse bars before which were fastened the vertical parts of the grille. To place the holes farther back would be technically incorrect and to be censured from an esthetic point of view. Where would the grilles reach the architraves, if they were arranged to be as far back as represented in Fig. 626. The returns of the base are not without precedent, as already stated; they are justified by the Florentine relief (Fig. 672), and their existence at the Temple of Vesta is also further vindicated technically, if the wall of the podium (not its projections) is set back a few inches. We obtain one of the best illustrations of a circular temple by the two relatively well preserved Temples in Tivoli and on the Tiber in Rome. The one is a temple with steps, the other having a podium without any vertical subdivision of the substructure (Fig. 676) and therewith indeed the most splendidly located one in the entire world!

443. Rustic Ashlars on Wall of Cell.

For the treatment of the exterior, a single existing example should not be forgotten, which shows rusticated ashlars in combination with the delicate details of the pediment facade; the Corinthian hexastyle stepped Temple at Termessos[479] that as a further exception to the rule exhibits at the rear an apse, internally semicircular and externally rectangular. "The external walls are more than 3.28 ft. thick and are built of boldly rusticated limestone ashlars in alternately high and low courses. The exuberantly powerful crudeness of the ashlar masonry, still standing to a height of 8.2 ft., is in abrupt contrast to the rich treatment of the vestibule, to which belong the shafts of the columns and parts of the entablature, as well as the doorway jambs and other dressed stones."

Note 477. See Jordan, H. Der Vestatempel und das Haus der Vestalinnen. Berlin. 1886. Further, Auer, H. Der Tempel der Vesta und der Haus der Vestalinnen. Vienna. 1888.

Note 478. Same, p. 89.

Note 479. Niemann, G. and E. Petersen. Städte Pamphyliens und Pisidiens. Vol. 2. p. 84, 85. Vienna. 1892.

444. Roof of Domed Building.

For the great rotundas the domical vault also forms the roof. The main cornice of the cell was placed much higher on the exterior than the impost cornice in the interior, by which the complete hemispherical form of the valut was not visible externally, but only the flat appearing upper half. The transition from the cornice to the vault was then obtained by an annular stepped structure. Gilded bronze tiles, marble and clay tiles or merely a smooth coat of plaster projected the external surface of the shell of the vault.

445. Construction.

According to the means at hand, the magnitude, the importance of the city, where the temple was to be erected, and according to the population was determined its more or less rich and monumental execution. In imperial Rome the most costly kinds of marble and granite scarcely sufficed, while men were contented in the provincial cities generally with plastered masonry of tufa or concrete with plastered columns of tufa or brickwork; these marble architraves extended from column to column, here were wooden beams covered by stuccoed members or terra cotta. Whatever material was also employed, genuine stone or plastered wood as a substitute therefor -- the temple at its completion gleamed with equally high color ornamentation, and which we still behold in the buildings of Pompeii. "We must become convinced, that formerly the temples, which are now ruins without color, were decorated by colors on the appropriate parts, with the exception of the temples and monuments of white marble."[480] The temporary use of color was succeeded in the splendor-loving imperial period by a monumental polychromy, by means of stones of various colors and of the noble metals.

Note 480. See Semper. Vol. 1. p. 498.

446. Covering Outer Aisle and Vestibule.

For the temples of the early time, when Etruscan architects

still played a leading part, the ceiling of the vestibule was composed of wooden paneling or of wooden beams with terra cotta; later occurred in their places stone beams and slabs. The horizontal stone ceilings imitated the wooden paneling; they formed coffered ceilings in the manner of Grecian temples, as they were in part constructed on the Parthenon or the Erectheum. Evidence of this is still preserved on the Temple Mars Ultor in the most splendid form, on Temple Vesta near Forum Romanum, on the round Temple in Tivoli, and on the so-called Temple Jupiter at Baalbec.(Fig. 677; section of the temple as now understood.[481]).

Note 481. Reproduced from the II Jahresbericht über die Ausgrabungen zu Baalbek. Berlin. 1903.

More difficult indeed would be the solution for the vestibule without columns -- the pars antica. For covering it might be used strong wooden beams with intermediate cross beams, and which were suspended from trusses, as shown in Figs. 678, 679.[482] But as at the Pantheon, the pronaos might also be divided into three aisles, two narrower side aisles and a wider central one. The solution was thus simplified, when the columns between the aisles were contracted in depth by architraves like the front columns, and the three aisles could be covered by tunnel vaults, as concluded from the form of the bronze roof trusses.(See Art. 256). From this form of ceiling indeed resulted the opening in the pediments of the later temples, that have remained at Spalato, on the Corinthian Temples at Termessos, Mesmije and Atil, on the Temple Astarte at Tripolis.(Compare Chapter 11 and Fig. 680). By these unusual arrangements more light was likewise obtained in the interior of the temple, if the opportunity was utilized as in Mesmije.(See Fig. 446).

Note 482. Reproduced from Encyclopedie d'Architecture. 1883. pl. 887; 1884, pl. 917.

We have in Termessos intercolumniations of 6.7 ft. from centre to centre and a central opening of 8.6 ft., thus being relatively small dimensions for a depth of 16.4 ft., or of 15.1 ft., measured to the centre of the columns. Therefore architraves 16.4 ft. long were required, which might be constructed of stone after the precedent of the Erectheum at Athens, and which indeed would be able to support the load of the coffered

slabs -- but whether also that of half a tunnel vault of stone, which must further be protected from thrust, must first remain uncertain. This is succesful in the Amphitheatres at Nimes and Arles (See Art. 204); there the funnel-shaped vaults of 10.65 ft. span rest on architraves 15.5 ft. long. With the use of a corresponding material, this was likewise possible in Termessos, and in this sense I give in Fig. 681 the section and adjacent perspective view of the ceiling of the pronaos of this Temple with arched architrave in the tympanum, where the stone architrave receiving the tunnel vault is assumed to be a straight arch composed of three pieces.

447. Internal Architecture; Stairway to Attic.

Corresponding to the external architecturwas also constructed the vestibule and the interior of the temple. The temple floor was composed of horizontal stone slabs of more or less valuable material or of mosaics.

Richly subdivided by columns and niches with figures were the internal walls of the cell, and they were covered with marble.[483], the ceiling being either constructed of horizontal wooden beams forming coffers, or as a semicircular coffered tunnel vault of concrete or of stone, extending from one side wall to the other.

Note 483. "In consequence of a warning of the soothsayer, I must improve and enlarge the Temple of Ceres on my landed estate - - -. I therefore desire you to purchase 4 marble columns, of whatever kind you please, and also marble for covering the floor and walls. A statue of the goddess herself will have to be made or purchased, since the old wooden one is mutilated in several places on account of its age." (Pliny to Mustius. Ep. 39. Book 8.).

A good representation of the architectural treatment of the cell of the oblong temple and of the appearance of the shrine with the figure of the deity, as well as the shape of the horizontal wooden ceiling, is given by Figs. 678, 679, after A. Normand's restoration of the Temple of Vespasian in Rome; Fig. 682 affords the necessary conclusions for the treatment of the walls and ceiling of a vaulted rectangular cell. In the imperial period (Temple Venus and Roma in Rome, Great Temple in Baalbec) the monumentally covered vaulted cell was preferred,

and there was thus created the peculiar combination of Grecian columnar architecture with Roman vaulted construction, with this likewise being that grander and more effective interior, thay Grecian temple architecture was able to show, yet certainly with the loss of unity and of the united harmony of the internal and external architecture.

If we disregard the restoration of the Temple of Venus and Roma at Rome (according to Fig. 682) and restrict ourselves to what is still tangible, then Fig. 683 gives for us the wall decoration still existing in the interior of the so-called Temple of Jupiter at Baalbec in all its heaviness and ostentation. And an example of a yet well preserved coffered tunnel vault constructed in compact white limestone over the cell of the so-called Temple of Esculapius in Spalato is shown in Fig. 685.

The attic of the interior and the roof itself must be made accessible without costly expedients, and which could only occur by stone stairways, as arranged in the Grecian temples in Akragas, and which still remain. They lay in the Temple of Venus and Rome in the side walls near the place in which the two apses touched; in the Pantheon in the angles at the junctions of the vestibule with the circular structure; they were on the right and left of the main entrance of the Temple of Jupiter at Baalbec (Fig. 684); in the Temple of Jupiter at Pompeii, at the Temple Magna Mater at Rome, and in the Temple at Timgad, walls parallel to the rear wall of the cell were simply constructed, leaving a narrow interspace, which was intended to receive the service stairs.

For circular cells, the ornamentation of the walls depended upon their magnitude. For small cells, this was limited to painting or covering the surfaces with marble; a richer decoration for larger ones was by square niches with columns placed between them (Figs. 317, 628, 673, 686), together with coverings of stucco, precious metals or marbles, painting and the placing of sculptures. Smooth domes covered by stucco and painting formed the ceiling in one case, in another being decorated by coffers with ornaments.

A representation of the architectural ornamentation of the walls is afforded by the well preserved interior of the Temple-

-Tomb of Diocletian at Spalato,(Fig. 688 [484]), even if we are left in doubt concerning the original mode of decoration of the ceiling; the Pantheon likewise supplies both the treatment of the wall and ceiling, even if not all be original.

Note 484. From a photograph of Wilha in Vienna.

448. Lighting of Cell and Attic.

The lighting of the cell during the day was by front and side openings and by skylights. Only one kind was employed or the others were added.

a. With front light only, the lighting occurred through the doorway in the end wall of the cell. The doorways of all remaining Roman temples are enormously large in proportion to the interior, to which they afford access, like the Grecian. Since likewise in the Roman temples but few men had to be in the interior, the doorways must have had another purpose, than to afford access or to close it.

Like the house of the ancient time, the temple cell only received light and air through the doorway, -- the lumen; hence here as well as there the great dimensions of the latter. With the leaves of the doors opened, it was possible for those approaching in their devotions to perceive the full effect of the colossal statue of the deity, even at a distance or just in entering the sanctuary. An intense lighting by daylight did not therefore occur, even if the decoration of the interior were so rich and the sculpture of the image of the deity was so refined and perfect. Antiquity placed as little weight on the critical observation of consecrated art works under the light of day, as is the case in the modern period in the conservative South. (For example, compare the delicate and splendid sculptures in the absolutely dark chamber of the Tomb of Ti, the paintings and art objects in Etruscan and Italian sepulchral chambers, the Madonna of Sansovino in S. Agostino at Rome, the Giovanni Baptista by Gagini in the choir of the Church of Calvestrano, interesting for its polychrome reliefs, and others).

What Alberti desired for Christian church Architecture must have indeed been true in ancient times for the pagan temple in the highest degree. "To heighten the dignity of ecclesiastical architecture, one chooses a moderate lighting of the interior,

since the reverence of the observer is enhanced by the dim illumination." He likewise arranged, "in accordance with the opions of anticuity," artificial illumination and fragrance dispensing flames.

If we select one of the best known and best preserved Roman temples, that of C. Caesar and L. Caesar, sons of Julia and Agrippa, of the 4 th year of our era, the so-called Maison Carree at Nimes, whose dedication and date are preserved[485] by an inscription with bronze letters in two lines and fastened by nails and cramps, then shall we find the ratio of lighting from the front not quite bad. Its cell measures (36.1 × 52.5) 1780 sq. ft., the doorway to this is (9.83 × 21.3 ft.) 197 sq. ft; without difficulty and since the interior is plain and in a single aisle, we obtain a ratio of 1 to 9 for the opening for light to area of floor of the interior lighted, which is nothing less than unfavorable. According to a note in Hittorf[486], 8 windows, each 3.60 ft. wide and 7.22 ft. high, would be necessary in order to afford the same amount of light in the cell as that entering through the doorway mentioned.

Note 485. Compare Desjardins, E. Geographie Historique et Administrative de la Gaule Romaine. Vol. 3. p. 220. Paris. 1885.

Note 486. In Architecture Antique de la Sicile. p. 465. Paris. 1870.

b. By side light is meant the lighting by windows in the cell walls, and whoch could usually be rarely employed; but it is shown by the tetrastyle Temple in Tivoli, the great and the small Temples in Palmyra, by both circular Temples of Vesta in Tivoli and of Hercules in Rome, whose windows are still preserved. It is self-evident in such an arrangement, that front and side lighting are combined, since the usual colossal size of the doorway is retained.

c. On the temples of the late period, the door and windows are frequently connected together, especially in Syria, so that above the cap of the main entrance doorway is placed a semicircular window (window for overhead lighting).

d. Lighting by means of skylights in the ceiling or roof remains on the Pantheon alone. The vast interior required and received such. No beating rain (not even now with the uncovered opening) could drive water against the interior of the

vault or of the enclosing walls; the distance from the edge of the light opening is too great; the rain was scattered far from them and fell harmlessly as a thin sprinkle of water on the pavement.

In the circular buildings believed to be temples, which with their smallness also have side windows besides the great doorway, no skylight was employed, or only that through a covering of glass; "no object beneath an opening in the dome (for a dome of small diameter) would have been protected from the weather."[487] According to precedents in Pompeii, a further enclosure of the skylight opening by bronze bars to receive thin polished plates of stone, mica or plate glass was within the realm of possibility.

Note 487. Compare Burckhardt.

The larger rotundas of similar form exhibit both the skylight and also the closed crown. The scarcely little Temple-Tomb of Diocletian at Spalato[488] was indeed only lighted by a skylight at the crown of the dome, covered by glass.

Note 488. Its cell has almost the same floor area as that of the Maison Carree in Nimes, and it is more than four times as great as the floor area of the middle aisle in the Temples on Egina and at Phigaleia.

e. Of the so-called hypethral lighting, which is now divided into direct and indirect, and which according to the evidence of Vitruvius (Book 3, 2) presumes a decastyle temple with a row of smaller columns set above the others in the interior, which are detached from the walls, so that they produce two narrower side aisles and a briader middle aisle. The former are covered and serve as internal passages; the latter has no roof, but is open to the sky. "An example of this is not found in Rome." We may believe him, although the Pantheon was a temple, and yet it still has a skylight, and also that of Jupiter Capitoline was furnished with an opening in the roof, (foramen in tecto), certainly in a different sense.[489] Vitruvius is not responsible for the Pantheon, if it dates from the time of Hadrian.

Note 489. If the Pantheon be a structure of Hadrian, then certainly Vitruvius could not speak of it. The temple termed decastyle by him was an uncovered court surrounded by porticos, where the columns around it extended through two stories and

galleries are indeed assumed in the interior.

Vitruvius (Book 3, 3) also states further on the contrary:-- "The view of the door leaves was further prevented by the close spacing of the columns, and the images of the gods themselves were obscured. ---".

A statement of Pliny (Book 26, 46 [490]) may likewise be mentioned here:-- "The Temple of Fortuna, who is called the seed goddess, was built thereof (phengites, phosphorescent stone), and accordingly the interior of the temple was light as day with the doors closed."

Note 490. Compare Art. 120.

If hypethral temples existed, the two last passages from Vitruvius and Pliny at least had on meaning; with the credibility of these authors in other technical matters, we have no reason indeed for mistrusting them here; with the simplicity and clearness of the statements, we are not embarrassed by explanation and useful applications.

The lighting of the attic was just as necessary in anticuity as in our own age, and a multitude of tiles found at Roman and Grecian buildings prove the arrangements for the admission of light to it. [491]

Note 491. Compare the examples in Art. 254.

449. Purpose of Porticos.

Not exclusively por producing an imposing design or for enhancing the architectural magnificence of the temple, but least of all to shield the house of the deity from profane view and to enclose it (for men intentionally arranged the houses of the deities open on the forums), did men erect the porticos at the temples, but for the protection of the visitors to the temple. Their purpose is clearly expressed in the previously quoted letter of C. Plinius to Mustius:-- "For on September 13 th a great number of people meet there from the entire country; many sorts of business are carried on, many vows are recorded, many payments are made, and yet there is in the vicinity no place of refuge against rain and the sun. Therefore I believe in acting like a generous and pious man, by making the Temple as beautiful as possible and adding porticos thereto:-- the former for the service of the goddess, the latter for the use of men."

What the private citizen built here on a small scale, the monarch created in the grandest manner, who built the Temples in Baalbec, that do not lack an imposing effect today. (Figs. 687, 688) These exhibit to us the propyleums with the massive flight of entrance steps, the hexagonal fore-court with its porticos, then the great Temple of Jupiter surrounded by columns with the porticos and exedras around the altar court and the great sacrificial altar. Fig. 685 affords information concerning the adyton, the special peculiarity of Syrian temples; it was elevated several steps above the floor of the cell and received within the sacred image.

Note 492. Reproduced from I. Jarhesbericht über die Ausgrabungen zu Baalbek.

450. Dimensions of Temple.

The dimensions of the temple occur in all possible magnitudes, like the Grecian, so that one frequently exceeds another in area about 24 times; thus for example, the so-called Temple of Esculapius in Pompcii has 452 sq. ft. of floor area, while the double cells of the Temple of Rome and Venus contain more than 10,760 sq. ft. The columns supporting the entablature were accordingly in one case only 13.1 to 19.7 ft. high, in the other being 59.0 to 65.6 ft., the shafts of the columns being from 1.48 to 5.90 ft. diaemeter.

451. Dwelling of Priests.

Dwellings for priests in the vicinity of the temple were given[493] by Antolini in the restored plan of the Forum in Veleja, that adjoined the Temple on its left side, while on the right side was built a comitium, an assembly hall for the councils of religious societies.

Note 493. Compare Guhl and Koner. p. 522.

The assured plans of such dwellings have been shown by the more recent excavations in Rome at the foot of the Palatine, in the Atrium of Vesta of the House of the Vestal Virgins, the residence of the most venerated and worthiest of Roman priestesses. Near the Temple rose the extensive building; we rocognize the great oblong atrium, surrounded by porticos, a tablinum, rooms of different sizes, stairways, and shops next the street without connection with the interior of the house.

452. Ruins.

452. Ruins.

In proportion to the extremely great number, to the magnitude, the solidity and massiveness of construction of Roman state buildings, very little has remained to us; much overthrown in ruin may be concealed by the earth and the mass of rubbish; most is irretrievably lost by the "demonic destructive power of mediaeval Rome," which fed its lime kilns with antique marbles; much has been swallowed up by Christian structures; many a Roman building owes on the other hand its preservation to a transformation into a church. Until in the 12 th century, men plundered Rome on account of columns.[494] Its marble buildings during the entire middle ages were the most preferred and most convenient stone quarries. The Roman system of concrete and brickwork masonry with a marble facing favored the removal of the latter, but there was preserved to us the massive nucleus of masonry.

Note 494. Compare in Burckhardt the foot notes on p. 10,27.

If from Aurelian's Temple of the Sun only the two well known colossal fragments of white marble yet remain, if from the Temple of Rome and Venus merely fragments of the substructure and a portion of the walls still stand, with merely a few stumps of its columns and the entablature is reduced to a single piece; still may one obtain an idea of the magnitude and the extent of the work of destruction completed by human hands.

Many of the ruins were devoted to other purposes, were rebuilt or were marred by later restorations and additions; but many yet exist in remains worth examination and exhibit vestiges of restorations during the period of the lowest decadence of Roman art.

Thus indeed the vast series of drums of columns at the Temple of Saturn on the Roman Forum results from a restoration in the 3 rd or 4 th century A. D., already referred to. The extreme column on the left has equal upper and lower diameters, since during the restoration a portion of the lower end of the column was inverted on the upper part. The marble bases are dissimilar; Attic and Corinthian alternate with and without plinths, and no two have the same height. The capitals indeed likewise belong to this later rebuilding.[495]

Note 495. Compare Reber, p. 92; -- further, Burckhardt.p.16.

Even at the Parthenon do we have to distinguish between accessories and plunder. Botched work of an ancient period is likewise no rarity in Pompeii and other places. To mention everything pertinent here would far exceed our limits; there suffices here the indication of a few examples.

If a monumental structure was prostrated during the good and mighty period by earthquakes, fire, or the storms of war, then the ruler of the world regarded as a title to fame the restoration of the destroyed building with greater magnificence and even sometimes with greater dimensions, if it could again serve its original purpose.

Within 1100 years have we seen the Carlovingian, the Romanesque, the Arab, that of the Renaissance to Barocco, Rococo and Empire, come and pass away -- but the Romans during 1500 years had only a single style, their own, which they carried into all lands, even if its roots are to be sought in Etruria and Greece. The fruits were ripened there when plucked by eternal Rome; but an immeasurable treasure was contained therein. And Friedlander estimates [497] with unusual accuracy in his spirited manner the grasp of the problem by the Roman people, and he clothes it in the words:-- "Far removed from striving for an impossible originality and from giving up the precious inheritance of the earlier fortunate period for fruitless experiments, it rather retained and employed this for a long time with praiseworthy insight." Dealing with seven different architectural styles was not required of the former masters of the world, and for them was substantially simplified the improvement, the restoration and the preservation of their buildings.

Chapter 19. Forum, Basilica and Rostra.

a. Forum.

453. Form and Dimensions.

For the forum or market of the Italian cities Vitruvius required the oblong form (Book 5, 1), whose sides are in proportion of 2 to 3 and whose area is surrounded by two-story porticos, behind which and on the same level are found the booths of the money changers with projecting rooms for spectators in the lower upper story, in order to there be present at the combats of gladiators, which after the custom of the earlier fathers occurred on the forum. It should not be too small, that the people be not crowded, neither too large, so that the folks might lose each other.

These proportions are not found at the best preserved Forum in Pompeii, for the area enclosed by porticos measures 467 × 126 ft., the breadth thus being to the length as 1 to nearly 4; but the Roman Forum is of trapezoidal form, and another Forum in Pompeii is triangular (Forum triangulare). Local conditions more commonly determined the form, shape and dimensions than the rule, which might rather correspond to the great imperial forums, which leveled a large portion of the city.

454. Purpose and Subdivision.

The forum originally served for both commerce and assemblies, and this must have always continued for the smaller squares; as for the larger and especially in the mighty capital of the empire, these purposes became separated eventually, and there were finally distinguished:--

1. The civil forums (fora civilia), open squares serving for assemblages of citizens and only adding the shops of the money changers.

2. The commercial forums (fora venalia), market places for traffic and the sale of goods of all kinds, according to which they received particular appellations, as/--

Forum olitorium -- market for vegetables.
Forum boarium -- market for cattle.
Forum suarium -- market for swine.
Forum piscarium -- market for fish.
Forum macellum -- market for meat and vegetables.
Forum cupedinis -- market for delicacies.
Forum pistorium -- market for grain and bread.

Forum nundinarium -- weekly and general market.

Forum at Pompeii.[498]

Note 498. Reprinted from Mau. Plate I, on p. 39.

A. Forum.

1. Pedestal of statue of Augustus.
2. Pedestal of statue of Claudius.
3. Pedestal of statue of Agrippina.
4. Pedestal of statue of Nero.
5. Pedestal of statue of Caligula. (?).
6. Pedestals for equestrian statues.
7. Pedestals for statues.
8. Pedestals for three equestrian statues.
9. Rostrum for speakers.

B. Basilica.

1. Vesbibule. (Chalcidicum).
2. Principal room.
3. Court room.

C. Temple of Apollo.

D. Market halls.

E. Privy.

F. Treasury. (?).

G. Arch.

H. Temple of Jupiter (capitoline).

J. Triumphal arch of Tiberius.

K. Macellum. (Market for provisions).

1. Vestibule.
2. Portico.
3. Shops.
4. Hall for meat and fish.
5. Chapel of the imperial family. (Claudius ?).
6. Festal hall for worship of the emperor.
7. Domed structure with water basin.

L. Sanctuary of the gods of the city.

M. Temple of Vespasian.

N. Buildings of the Eumachia. (Market for woolen goods).

1. Vestibule.
2. Portico.
3. Apse of Concordia.
4. Covered passage.
5. Statue of Eumachia.

O. Comitium.

P. Office of the duumvirs. (City magistrates).

Q. City council room.

R. Office of aedile. (Superintendent).

Imperial Rome could no longer be satisfied with a single civil forum; the imperial forums became others, which might all be regarded as magnificent extensions of the Roman Forum. Caesar, Augustus, Vespasian, Nerva (Forum transitorium or palladium) and Trajan, whose forum surpassed all others in splendor, were engaged in these enlargements, which received the names of their builders.

455. Construction and Surroundings.

The pavements of these forums were laid with stone slabs; (white travertine slabs in Pompeii); care was taken for the removal of rain water and sewage by channels or covered sewers. (Pompeii). The porticos around them afforded protection from sun and rain.

The civil forum not only comprised the porticos, but also the most important public buildings. The great Temple of Jupiter adjoined that in Pompeii on the northwest, with the 3 curias (city offices) on the southeast; at the ends were the Basilica, the Temple of Apollo, a market for fruits and vegetables, the Macellum, the assembly hall for the decurions (ten men), the school, the building of the Eumachia, and the Temple of the Genius of Augustus -- just as Vitruvius required.(5, 1,2).

456. Forums at Timgad and at Pompeii.

Two instructive examples of plans of forums are afforded by Timgad in Africa and Pompeii in southern Italy, represented in Figs. 690 to 692. The former was constructed after a uniform plan under the government of Trajan, while the other gradually in the course of centuries became what it was at the era of the destruction of the city. The letters in Figs. 690, 692, and their added explanations show, that the Forum in Timgad included merely a small temple, a curia, a city building and public privies, while the great Forum of oblong form in Pompeii measured 467 × 126 ft., exclusive of the porticos, enclosed by the Temple of Bupiter at one end and by porticos on the other three sides, behind them lying the Basilica, several temples, curias, markets, city offices and public privies.

The open space only served for assemblies of the community,

all carriages were forbidden there, and it could also be enclosed; access was through triumphal arches and arched gateways, and it was adorned by statues of men, who had deserved this from the city. A rostrum for speakers, as in the larger cities, did not exist here; addresses were indeed made from the steps of the Temple of Jupiter.

The general view of this Forum of Pompeii, produced in the course of time, must have appeared to the observer more effective than the academically more correct one of Timgad, although a certain distinction cannot be denied to the latter, in part due to the genuine stone as its material. (Fig. 691).

457. Roman Forum.

On the Roman Forum, the magistrate made his announcements to the people; the generals reported their acts there, political trials (Coriolanus, Manlius, Scipio, Jugurtha, Verres, etc.) were held there; the forbidding of festivals and games was custimary there.

The buildings surrounding this place, on which was played a great part of the history of the world, are shown by the ground plan in Fig. 694 on the basis of the discoveries in the year 1902. Whatever still rose more or less above ground after 2000 years appears in the views in Figs. 693, 695, one view being towards the Column of Phocas, the other towards the Tabularium. But they likewise show how the view of this noblest and most significant locality in the world has changed since the beginning of the centuries, which have flown past (Fig. 697), and likewise what the burning emulation and inspiration of the cultured nations of Europe have done for the ancient culture and art, when they removed the mass of rubbish, that in the year 1824 still concealed the memorials of the ancient world, and permitted their magnificence to revive again before us. A famous deed was here completed, especially if we consider, that the leading spirits were satisfied with baring the ancient treasures, and did not undertake useless and erroneous attempts at restoration, only directing their endeavors to preserve what the soil of eternal Rome had so long and carefully covered and faithfully preserved for us. An animated representation of the Forum in the ancient time is given in Fig. 696[500], viewed from the Basilica of Maxentius toward the Tabularium.

Note 500. A thorough history of the Roman Forum and its monuments with 3,plans and 109 illustrations in the text by Professor Dr. Chr. Hülsen has recently (1904, June) appeared in Rome, to which I refer with the greater pleasure, since the author has frequently aided me in my work in a manner deserving my gratitude. The contents of the book are divided into 44 sections and comprise the history of the Forum from its beginning until the most recent excavations since 1898; then the monuments of the Forum; its temples, triumphal arches, basilicas, comitia, Regia, Curia Julia, Prison, Rostrum, the Golden Milestone, etc., with various pretty restorations by Tognetti in Rome. -- Also compare Theodenat, H. Le Forum Romanum et les Forums Imperiaux. Paris. 1904.

But how the Roman Forum was extended in ancient times, we are informed by fragments of the Capitoline Plan and the ruins on the localities -- of the imperial Forums of Caesar Augustus, of Nerva, of Vespasian and the most splendid among all, that of Trajan, whose Memorial Column and the surrounding columns of granite amaze us today. (Fig. 698 [501]). Massive are the finely jointed ashlars of the Forum of Augustus, and an architectural masterpiece is and remains the false portico of the Forum of Nerva.(Fig. 699)! We cannot sufficiently prize these mighty evidences of the architecture of the Roman world, that still throws into the shade everything ever created in this domain of high art.

Note 501. Reproduced from Baedeker, K. Mittelitalien und Rom. By Chr. Hülsen. 13 th edition. Leipzig. 1903.

In like manner as in Timgad and Pompeii do we see the Roman Forum surrounded by basilicas and temples, magnificently adorned by triumphal arches, memorial columns, fountains, its strucures rising on the north of the Capitol. Of these buildings located on the "warmest side"(Vitruvius, Book 5, 1) of the Forum, the Basilica is to be examined further.

b. Basilica.

458. Origin.

From its name (stoa basileos -- basilica stoa, i.e., royal hall), the basilica may be of Grecian origin, and it might be referred to the Royal Hall in Athens. It probably first received its development in the grand style by the architects of and his successors. "Here (Alexandria architecture at first

adopted the grand internal arrangement of the Egyptian temple=palaces and especially the form of the basilica - - - (buildings) arose after the great models of the Egyptian monuments."[502] The hypostyle Egyptian halls must have supplied the model for the corresponding buildings of Alexandria. Vitruvius (Book 6, 3) also says of the Egyptian halls, that they appear to have greater similarity to the basilicas than to banquet halls.

Note 502. Compare Semper. Vol. 1. p. 481.

459. Purpose.

The basilicas had to serve business men for commerce and assembly; they were to be accessible and usable "in winter without annoyance by weather" (Vitruvius, Book 5, 1). This single requirement of Vitruvius already presupposes an enclosed and roofed interior and excludes any hypethral hall. Men later added to this "ancient bourse" a court room, which was placed at the rear end, elevated and separated from the trade assemblage. It received in an apse the seat of the praetor and his officials. Since as previously stated, great multitudes came to traffic in the basilica and must take part in the proceedings or keep an appointment there, its dimensions were to be made as great as possible. To what mighty works men proceeded is shown by the three-aisled Basilica of Maxentius, whose cross section is so conceived, that the five-aisled Cathedral of Cologne, placed within it and its entire arrangement of arches and buttresses, does not reach with its extreme projections to the outer walls of the side aisles of the Basilica. (Fig. 700).

460. Ground Plan.

For this species of structure, the ground plan was not restricted to a fixed scheme of plan. This is sometimes in a single aisle (Aquino, Praeneste, Treves[503]), sometimes a three=aisled (Otricoli, Pompeii, Masilica of Maxentius) or a five=aisled one.(Basilica Julia, built for the court of centumvirs, Basilica Paulla and the most magnificent of all, the Basilica Ulpia, (Fig. 698), whose ground plan is fixed by fragments of the Capitoline Plan of the city.

Note 503. Hettner (in Das Römische Tur, p. 13, 14. Treves. 1880) says: -- The ceiling, "as it is now restored, must have extended over the entire interior without supports." Yet early plan drawings permit the belief, that a galle

plan drawings permit the belief, that a gallery may hawe been built to the height of the first row of windows with a continuation of this to the ceiling by two others. Since the latter would not accord with the arrangement of the windows in the facade, Hettner criticizes this assumption.

Vitruvius (Book 5, 1) prefers a rectangle for the ground plan, whose width is not less than one third nor more than one half the length, unless the natural conditions of the site require otherwise, and for a greater length, "chalcidic halls" (anterooms like vestibules) should be arranged at the ends. At the Basilica in Fano,[504] the side aisles were 20 ft. wide and were extended around the middle aisle, which was as 1 to 2 (60 × 120 ft.). To the court room was assigned either a rectangular (Pompeii) or a semicircular forc, the latter appearing to be the later one.

Note 504. Compare Prestel, J. Des Marcus Vitruvius Pollio Basilika zu Fanum Fortunae. Strasburg. 1901. With an attempt at a restoration of the building, which agrees in many respects with the conception of Reber; but it assumes a horizontal terrace roof for the side aisles instead of a visible shed roof. The architecture of the facade is not strictly in the style of the Augustan period. Against the charges of Schulz, "that Vitruvius was a foolish man without any conception of architecture," protests have justly been made.

461. Cross Section.

For the 3-aisled design, indeed that most common in the time of Vitruvius, the side aisles were half as wide as the middle aisle, and the height of the lower columns was the same as the width of the side aisle, the wall band between the lower and upper columns being so high, that those walking around in the upper story could not be seen by the business men.(Fig. 701[505]).

Note 505. A restoration from the edition of Vitruvius in the year 1556 by Monsignore Barbaro, Patriarch of Aquileia.

For "the development of the highest dignity and beauty," Vitruvius recommends instead of the columns set above each other, those extending from floor to ceiling of the middle aisle, on the rear side of which are placed pilasters having about half the height of the columns, and which support the floor beams

beams of the gallery, just as he did in his Basilica at Fano. (Fig. 701). Above the lower pilasters were placed others, that were lower and bore the framework and roof of the Portico, "arranged to be somewhat below that of the middle aisle."

This passage and the following important closing advice of Vitruvius:-- "The space between the beams above the pilasters and those above the columns is to be left open for light entering through the intercolumniations"-- causes the elevation of the middle aisle and makes the wall of the middle aisle, rising above the roof of the side aisle, to become a clearstory. According to the rather brief statements of Vitruvius, one might assume the columns of the middle aisle to be complete columns, which would result in an impossible solution for the addition of the roof and the development of the raised walls of the middle aisle. But the construction would be more appropriate, if one assumes the truly Roman half or three-quarter columns instead of complete columns, with which a good connection may then be made with the pilasters and beams.(Fig. 701). The elevation of the middle aisle is likewise shown by the Basilica of Maxentius, and the occurrence elsewhere of such raised roofs is proved by Pompeian mural paintings.[506]

Note 506. Lange has given and illustrated in Plate 4 of his work (Haus und Halle. Leipzig. 1885) a collection of buildings with raised roofs over middle aisles from Pompeian mural paintings.

462. Ceiling and Roof Framework.

As at first stated, the basilicas were covered against the injuries of the weather, indeed being constructed with horizontal coffered wooden ceilings, or the open framework of the roof was visible, just as in Vitruvius' Basilica in Fano, in order to lessen the cost and labor, or they were vaulted, of which the Basilica of Maxentius is the only example.(Fig. 702).

The outer walls of the other basilicas known are of such dimensions, that they could present no resistance to the thrust of a vault. The Basilica in Chagga (Syria) of the 2 nd or 3 rd century A.D. indeed exhibits in its interior the three-aisled plan and stone arches on piers; but the ceilings of the aisles are again covered by horizontal stone slabs, just as the early basilican churches of Syria of the 6 th century are

chiefly built as 3-aisled basilicas with a semecircular apse, side chapels and vestibule, in which the apse and the supporting arches are of arched form, but the aisles are covered by visible wooden framework.[507]

Note 507. Compare De Vogue. Tourmanin, Baquoza, Qualb-Louzeh.

The bronze roofing of Basilica Ulpia mentioned later must not be regarded as a metallic construction, as for the vestibule of the Pantheon; it must rather refer only to the covering material -- gilded bronze tiles.

Compare Pausanias, Book 5, 12:-- ". . Among the monuments, which he (Trajan) caused to be erected, the most noteworthy are - - finally the Roman Forum, already wonderful for its former beauties, but particularly on account of its bronze covering." -- The middle aisle of the Ulpia was 82 ft. between axes, and the covering of this interior was formerly declared impossible by learned men, otherwise conscientious, but in the interest of a bypothesis no longer accepted. For example, Hübsch was too practical and knew the ancients too well to believe earnestly in the validity of his statement. Moreover, wooden roof trusses up to 148 ft. span were already constructed according to the same simple principles as those of the Early Christian (or late Roman) basilicas.[508]

Note 508. See the roof trusses of the Festival Hall at Zurich in Part IV, Volume 4 of this "Handbook". (Third edition; Fig. 286, p. 246).

Guadet says:[509] --"The middle aisle of the oldest Christian Basilica of S. Paul-without-the-walls in Rome was just as wide as that of the Basilica Ulpia. The material of the one might serve for the other. And just as Constantine had his Triumphal Arch built from that of Trajan, he might just as well likewise take the woodwork of Basilica Ulpia (98 A.D.) for his Christian basilica, by so much the more, that men could then only procure with difficulty timbers 82 ft. long from the Lebanon mountains. The visible wooden trusses over the middle aisle of S. Paul existed until its destruction by fire in 1823; it was repaired under Honorius in 395 A.D., and probably thus with proper maintenance and the necessary repairs lasted for nearly 1500 years."

Note 509. In Daremberg & Saglio. p. 680.

But if we are unwilling to accept the views of Guadet, it is still shown in the roof trusses of S. Paul, that Roman antiquity was still able in the time after Constantine to span interiors of 82 ft. with wooden construction; and what was then possible must have been still more common during the preceding period of superior powers.

The earlier view that the middle aisle of the basilica was not covered is to be held no longer. From the fact that in the floor of the middle aisle of the Basilica in Pompeii are cut channels for water, an uncovered central space was assumed; but one must rather assume, that a room much used and especially in bad weather, into which dirt was continually carried from outside, frequently required cleansing thoroughly the floor, and that for this purpose were required water jets and care was necessary for carrying off the cleansing water. And a discharge of water from the floor does not always presuppose a hypethral design. If we summarize what has been stated, there results as a characteristic for the legal basilica:-- the plan in several aisles with an elevated and covered middle aisle and high side lights, the extension of the side aisles across the ends, one of which is connected with the vestibule and the other with the court room, like an exedra. (Compare the Basilica at Pompeii in Fig. 703). "The basilican form was adopted by the Christians for their churches -- since temples with their small interiors were not (or but seldom) satisfactory."[510]

Note 510. Compare on this, Burckhardt, p. 38. -- Further, Lange, p. 312; the evidence of the latter in this respect is convincing.

463. Age.

The first basilica in Rome was built by M. Porcius Cato as Censor in 184 B.C., which from him bore the name of Porcia and was preferably a basilica for the courts of justice. Even in republican Rome were built Basilica Fulvia in 179 B.C., the Sempronia in 170 B.C., then the Aemilia, the Opimia, the Paulli, and the Julia (dedicated in 46 B.C., begun by Caesar and completed by Augustus, later burned and rebuilt).

As a peculiarity of the last named building in five aisles (Fig. 704; reconstruction after Hülsen and Tognetti[511]) must

be mentioned the arcades resting on piers instead of closed external walls, and which open on the Forum and the two side streets extending at right angles to it. The superstructure was supported by 120 piers, was 335 ft. long and 161 ft. wide, and its middle aisle was 52.5 ft. wide. The floor of the central aisle was covered by slabs of noble kinds of colored marbles, with white marble tiles in the side aisles. The middle aisle was separated from the side aisles by enclosures of white marble; the inner piers were of square section with 4 projecting pilasters; the outer ones had on the external side half columns without flutes.[512]

Note 511. Details of this structure may be found in Notizie degli Scavi di Antichita. p. 47. 1883.

Note 512. Reproduced from Hülsen, Ch. Das Forum Romanum. Rome. 1904. Also after the restoration of Tognetti.

Besides the theatres and the Colosseum at Rome, the interior and exterior indicate one of the most beautiful solutions in the domain of the prigressing Roman art of vaulting on piers. The same basal idea of vaulting is as well carried out for the side aisles in the lower story as for the theatres and amphitheatre mentioned, in which the cross vault is avoided by the arrangement of a continuous tunnel vault over the arched openings toward the middle aisle and the Forum. For the upper galleries, the horizontal ceiling was constructed with a terrace roof, which last may have risen around the higher central structure with its elevated admission of light.

The most important basilica was that built under Trajan, the Ulpia, probably by Apollodorus of Damascus (see the plan in Fig. 698), the last being that begun by Maxentius and completed by Constantine on the Roman Forum, whose middle aisle was more like a hall of the baths.

The list of regions (wards) enumerates 10 basilicas in all in the time of Constantine. Of basilicas outside the city of Rome, those in Otricoli, Herculaneum, Pompeii, Praeneste and Treves are especially to be mentioned. Further information concerning the different basilicas of republican and imperial Rome, as well as those outside the capital, is to be taken from Lange (in the work mentioned in Note 506. p. 153 - 243).

In the first edition of this volume (1885) and in accordance with Burckhardt and Lange, the principle was stated, that the Christians adopted the basilicas of the pagans as models for their churches, but it is now carried further by Riegel[513] in a very finely worked out manner, that the Christian basilica originated in the 3 rd century A. D. in the Roman empire, but not independently from all relations to contemporary architecture, and that it is rather to be referred to the secular market basilica, which was nothing more than a composition of 4 porticos, opening around a common oblong court, where the artistic element was in the interior of the porticos. These porticos were intended for the assemblage of the community, rooms for coming and going, the vaulted abse without windows -- "a halved central structure" -- the half of a rotunda with a circular dome, the room in the church required for the sacrifice! The house of worship, which was first gradually developed "at the end of the 2 d century," was conceived as the place in which the community participated in the saving effect of the sacrifice of the mass offered by the priests." The act of entirely mystical significance must be performed within closed walls, where no one could be a witness, who was not thoroughly prepared. There the apse was less to serve for occasional interest; for the Christians it was the focus of the devotion of those assembled," and therefore the portico of the pagan basilica was removed from before it, while the duplication of the side aisles in both confessions had at first the same purpose, and only later, when the interior was surrounded by porcos and became the didde aisle, did this increase in the number of side aisles contribute to increase the architectural effect.

Note 513. In Zur Entstehung der Altchristlichen Basilica. Jahrb. der K. K. Centralcommission für Kunst und historische Denkmale. Vol. 1. 1903.

"The Basilica of Maxentius on the Roman Forum stands with its vaulting partly destroyed,[514] but it already shows in its plan a fundamental variation from the typical basilican scheme, and it is at most to be regarded as elementary, and which could find no successor in the path pursued." Models for the subdivision of the middle aisle into square cross vaults were the

halls of the baths; but these were utilized in the Basilica of Maxentius in a different sense. The longitudinal structure with a view along the longer axis toward the vaulted apse was the pagan architectural idea, as well as the later Christian; in the baths the tepidarium with its three cross vaults was merely an interior intermediate between the equally vere impressive portions, the caldarium and the frigidarium, the internal effect along the structural axis being considered. One cannot remove portions of this building from the whole for comparison with similarly appearing entireties of another species. Here are common only certain technical procedures, but not the esthetical. But if the Basilica of Maxentius be assumed to be merely rudimentary, to be regarded as a first essay without any successor in that line, this can only be true for the immediately succeeding period. The Christian middle ages adopted the idea and its technical embodiment, and whatever the Romanesque and Gothic cathedrals present, the perspective effect of the interior, the enhancement of the middle aisle as the principal interior, the system of buttresses, the stepped heights to the ceilings of the aisles, the overpowering and lofty admission of side light -- in brief, everything, which the 4 th century of the Early Christian period has made known to us in the single example, it reappears in lessend magnitudes and colthed in a changed expression of form in the cathedrals mentioned, together with the accenting of the longitudinal axis, the subdivision of the ceiling into cross vaults, and the apse as the points most impressive for the visitor.

Note 514. From Riegel.

This was referred to in Chapter 5 (under b; Vaults) and the corresponding comparison was made; it is also now shown in Fig. 705, that one of our interesting Rhenish churches -- S. Maria-im-Capitol at Cologne -- may be placed within the Basilica of Maxentius, and that the 5-aisled cathedral of Milan is internally smaller than it, and in Fig. 706, how narrow are the widths of the bays of Cologne Cathedral in proportion to those of this antique basilica, while Fig. 702 presents a bird's eye view of the construction of both the interior and the exterior. Fig. 707 exhibits the ground plan with its former addition of porticos and temples, while Fig. 708 shows the present condition of the ancient structure with its three mighty

coffered side vaults and the projecting buttresses -- memorials of departed grandeur, still rising massively in our day, 1500 years after their origin and speaking to us of the mighty Roman people, rulers of the world.

In the Basilica at Pompeii[516] is best preserved the normal ground plan of the pagan basilica (Fig. 703); but it is otherwise with the superstructure. In Pompeii five entrances lead from the Forum into an entrance hall, that lay about 4 steps below the floor of the Basilica. Only moderately high stumps remain of the 28 internal brick columns (which were formerly covered with stucco), 3.61 ft. in diameter; to these correspond half columns of smaller diameter on the enclosing walls, so that a second series of half columns must be assumed above the latter, which then gives the same height for the three aisles. A high side light would be required between these for lighting the 3-aisled interior, which was introduced through pairs of windows in the side external walls, indications of which are found in the remains of the building.

Note 516. See Mau, p. 64 et seq.

As shown by the plan, the court room is in form more Greek than Roman and differs from the normal form of the semicircular apse. The roofing of the building affords Mau opportunity for reflection, and he is of the opinion, that the middle aisle had its separate roof supported by 28 columns, adjoined by the somewhat lower terrace roofs of the side aisles. I believe rather in a common gable roof over the three aisles with the so-called visible framework.

On this side of the Alps, there stands in Treves a Basilica of the time of Constantine,[518] which in spaciousness, i.e. in reference to width of span, is not inferior to the Basilica Ulpia or to the middle aisle of the Basilica of Maxentius in Rome. It is a room of rectangular area, 91.0 ft. wide and about 181.0 ft. long, with an original height of the building equal to at least 102 ft. It is carefully constructed of bricks, where the mortar joints are made as thick as the bricks themselves. The mortar employed there consists of coarse sand with the addition of pounded tiles, the foundation is composed of limestone. Beneath the pavement of the hall and for its entire extent is arranged a hypocaust, that indeed served

for keeping the floor dry, rather than for warming the room. The walls are externally subdivided by vertical projections, which are connected at top by round arches. In these recesses are two rows of windows, one above the other, that admitted abundant light into the single aisle of the interior. Before one end was formerly placed a portico; the other opened into a semicircular apse 61.5 ft. in diameter. Judging from numerous fragments of tiles, the building was covered by a flat tile roof. In the angles of the walls at right and left of the apse lie two circular winding stairways with newells, such as we have become acquainted with in the imperial palaces in Treves and Arles, as well as the Basilica Maxentius at Rome, dating from the same period. The face arch of the apse is constructed with three rows of bricks. The doubled rows of the bricks at the windows are separated by flat tiles in accordance with the custom of the time. The masonry of the walls in arches and tympanums first occurs here. (Fig. 709; plan and section).

Note 518. Compare Schmidt, Ch. W. Baudenkmale in Trier und seiner Umgebung. p. 51. Treves. 1836.

The spans of the Ulpia and of the first Christian Church in Rome, S. Paolo-f-l-M., are alike 82.0 ft.; the span of the Basilica in Treves is 90.5 ft., thus exceeding the former by about 8.5 ft. The construction of the wooden trusses was doubtless excellent, and it affords new evidence that the ancients did not shrink from great problems in practical carpentry, but likewise understood how to solve them.

Besides this Basilica in the residence city of Constantine on the Moselle, there were likewise prominent others in single aisles in Praeneste and Aquino. Basilicas with one, three and five aisles are further to be mentioned, with ceilings of uniform or of different heights, an example of the last of these being the Basilica of Maxentius alone, as proved by its construction, in which monumental vaulting was employed, and not a perishable wooden ceiling.

A 3-aisled Basilica in Jerusalem and built by Herod is mentioned by Josephus[519], where the raising of the side aisles and the subdivision of its clearstory walls by half columns are especially described. Likewise in Aspendos, Petersen and

Niemann[520] locate the possible cross section of a 3-aisled basilica with a raised side aisle 36.5 ft. wide, but which appears too incomplete.

Note 519. Josephus. Antiq. Jud. XV, 2 etc.

Note 520. Vol. 1. p. 96, 97.

For the superstructure and the development in height of the Early Christian 3-aisled or so-called normal basilica with the arrangement of wooden ceilings of different heights, an assured model is not fixed in the pagan legal basilica by any erected example, still authentic in all parts. Our conception of the latter is chiefly based upon inference, perhaps deceptive! However it is certain, as also Borrmann and Neuwirth decide,[521] "that the basilica was a hall divided by colonnades may be correct, but that it was likewise "basilican", i.e., lighted by a raised middle aisle, and that in consequence the idea of the basilica was attached to a definite form of cross section, is a conclusion not demonstrated.

Note 521. In Geschichte der Baukunst. Vol. 1. p. 227. Leipzig. 1904.

c. Rostra.

464. Rostra.

An important structure on the Roman Forum consisted of the platform for orators, termed Rostra, from the iron beaks of vessels hung there after the conquest of Antium. (338 B. C.). Lying on the longitudinal axis of the Forum, it formed its western boundary between the Arches of Tiberius and of Septimus Severus.(See the Plan of the Forum in Fig. 694, p. 613). It was built in the time of Augustus as a stone podium (platform) 78.8 ft. wide and 9.85 ft. high, recessed at the rear by cutting broad steps for the speaker to ascend. From the Rostra was published important imperial proclamations. Statues, memorial columns and fixed balustrades ornamented and enclosed it in a dignified manner. Its most beautiful decoration was received under Trajan by the so-called Anaglypha Trajani, precious marble balustrades adorned by reliefs, which became famous on account of their artistic execution and preservation; the latter is due to the fact, that they were built into masonry until 1872.

Different attempts at restoration of the form of the podium

and of the location of the balustrades, which are given in Figs. 710 to 712 (Plans, elevations and perspectives). The The plan with the segmental rear is now considered as best; from a purely artistic point of view, I would give the preference to that drawn by Schulze. A second platform for speakers was afforded by the steps to the Temple of Castor.(Fig. 657). Both are problematic in elevation, of that first mentioned the only authentic parts being the plan with the segmental steps near the Golden Milestone (umbilicus) as well as Trajan's balustrades, as already stated.

A thorough treatment is given by Richter in the paper mentioned below.[522] Also compare the Rostra at the Temple Divus Julius on the Roman Forum and its restoration in semicircular form by Schulze in the essay mentioned below.[523]

Note 522. Richter, O. Die Römische Rednerbühne. Jahrb. d. Kais. Deutsch Arch. Inst. Vol. 4.(1889). p. 1 to18. Berlin. 1890.

Note 523. Schulz. Die Augustusbauten auf dem Forum Romanum. p. 140, 141. -- Further, see Hülsen, Ch. Die Ausgrabungen auf dem Forum Romanum. 1898 - 1902. Mitt. d. Kais. Deutsch Arch. Inst. Röm. Abth. Vol. 17. Heft. 1. -- Die Baugeschichte der Rostra in der Kaiserzeit. Same. p. 20, 21 and plate 2. -- Also Petersen. Die Reliefschranken auf dem Römischen Forum. Abhandlungen A. von Oettingen zum 70 Geburtstag gewidmet. p. 130 to 143. Munich. 1898. Mitt. d. Kais. Deutsch Arch. Inst. Röm. Abth. p. 326 etc. 1897.

Chapter 20. Other Buildings for Public Assembly; State and Administration Buildings.

465. Buildings for Public Assembly.

The treasury, prison and curia (city hall) must adjoin the forum and must be built in accordance with the dignity of the state, especially the latter. Its plan may be square or oblong; the height being 1.5 times the side. This and also other rules for improving the acoustics of interiors is pretty all that Vitruvius (Book 5, 2) says in regard to other public buildings, which should stand on the forum. Their remains are just as scanty or doubtful and as unexplained as this text, and Burckhardt's [524] words in this connection are only too true:- "The buildings for public assembly are unfortunately, in regard to their artistic form, more an object of archaeological research, than of artistic satisfaction; so little do the ruins represent, and upon which we have to depend exclusively." But we should not then forget, that the transaction of state affairs frequently occurred in temples or on the forums' thus we know that the Temple Concordia served as a hall for the sittings of the senate, and that the temple Saturn was assigned to the questors as an office.

Note 524. Burckhardt. p. 38.

466. Comitium and Curia.

As commerce and market traffic were on the Forum, so then the adjoining comitium was then the chief place for the assembly of the people and for the sittings of the courts of justice. [525] Here lay the city hall -- the Curia -- and the Mamerttine Prison. The latter was described in Art. 221; like this, the former has remained to us. "A tall building of bricks with plain facade on the border of the present excavations," like the House for the sittings of the Roman senate built by Caesar, the Curia Julia, which was restored by Diocletian in 305 A.D. and in 625 was dedicated as the Christian Church S. Adriano. Its plan is given in Fig. 713, from which it is evident, that besides the great hall of assembly were arranged a hall for secret sittings (Secretarium Senatus), other halls, chapels, and courts with porticos.(Atrium Minervae).

Note 525. Hülsen compares the combination of the two (in Baedeker's Mittel-Italien und Rom. 13 th edit. Essen. 1903). very strikingly with the Piazza and Piazetta in Venice.

The only model for the Curia Julia yet found must be the City Hall (Curia) of Miletus.[526]

Note 526. Compare Archaeol- Anzeiger. 1902. Heft. 4. p. 154. -- , where Luckenbach has also called attention to it. -- Concerning the plan of the Curia, see further:-- Hülsen, Ch. Das Forum Romanum, a restoration. p. 98. Rome. 1904.

See further:-- Hulsen, Ch. Das Forum Romanum etc. Rome. 1892. -- Further, Hülsen, Ch. Die Ausgrabungen auf dem Forum Romanum von 1898 bis 1902. Comitium und Curia. Mitt. d. Kais. d Deutsch Arch. Inst. Röm. Abth. Vol. 17. Heft 1. p. 22. Therein also reference is made to the "Lapis niger" (black stone) and the "Grave of Romulus", as well as to the "Archaic Stele," all discovered in 1899. -- But especially to the 4 th Jahresb. über neue Funde und Forschungen zur Topographie der Stadt Rom. Rome. 1892. Reprinted from Mitt. d. Kais. Deutsch Arch. Inst. Röm. Abth. Vol. 8. (1894) p. 278.

Varro mentions three curias in Rome:-- the Hostilia, Pompeia and Julia, two of them located on the Comitium and one on the Campus Martius.[527]

Note 527. Compare Reber. p. 114.

Three buildings in Pompeii are also held to be curias and tribunals, which are characterized by their rectangular ground plans, wide entrance doorways (through which they received light, since the outer walls are without windows) and semicircular or rectangular apses. Nissen designates them as:-- 1. Hall for the sittings of the decurions; 2. Business or official House of the judicial decemvirs; 3. Business Office of the aediles, and these are quite probable,[528] since the three buildings differ from each other in form. Their floors, walls and facades were covered with marble. As a curia or small senate house (senaculum) likewise appears the so-called Hall for the sittings of the decurions in Pompeii, a large room, open in front, covering a floor area of 60.5 × 62.5 ft., with an apse and rectangular additions on the sides, in the midst of which stood an altar. But the great opening next the street rather permits the conjecture of an atrium with niches.

Note 528. Compare Overbeck. p. 139.

467. Tabularium, Curia and Comitium.

For the reception of the tablets of the laws and the decrees

of the state, the Tabularium (Archives) was built by L. Catulus in 78 B.C., whose open arcades were next the Forum, and which was at the same time the place for the official business of the tribunes and the aedile, while that of the censors was found in the Atrium Libertatis.

468. Diribitorium.

The Diribitorium begun by Agrippa and completed by Augustus, in which were distributed the voting tablets for the comitias, later gifts to the people and pay to the army, we know only through Pliny (Ntg. 16, 76, 2), that a beam 100 ft. long and 1.5 ft. thick remained, which was preserved as a wonder in the Hall of the Septa on Campus Martius. Cassius Dio terms it the largest structure ever roofed over, but it remained uncovered, since the fallen roof could not be again restored. Agrippa left it unfinished at his death, but it was finished by Augustus.

469. Septa.

The Septa (enclosure) was originally a space slightly enclosed by ropes and wooden barriers, within which the centuries (tribes) separately gathered for voting at the assemblies of the people. Julius Caesar made this place a monumental structure, which Lepidus continued and Agrippa completed and dedicated in 27 B.C. under the name of Septa Julia. According to fragments of the Capitoline Plan, it was an area surrounded by stately porticos adorned by art works, so large that it served for popular assemblies, combats of gladiators and sea-fights.[529]

Note 529. Compare Reber. p. 279 - 281.

Cicero praised the design, entirely built of marble with a grand portico, which Pliny likewise mentions, and which consisted of an area surrounded by sevenfold porticos.[530]

Note 530. See Reber, F. Die Ruinen Roms. 2 d edit. p. 279. Leipzig. 1879. -- Also Lanciani. p. 47.

Remains of this structure are to be found in the cellars of Palace Doria. There are shown 8 piers in the width and 160 in the length, together with two each of T-shape on the facade and 6 square ones within one bay. -- The corresponding fragments of the Capitoline Plan of the city are published in Reber, p. 249 and Fig. 26.

The so-called Schola on the Forum in Pompeii is also designa- as a voting room.

470. Regia. (Palace).

A more important building, though not made clear in all its parts, was the Regia on the Roman Forum, whose architectural remains date from the era after the fire of 36 B.C. and belong to the finest that covered the pavement of the Forum. According to tradition, it was the residence of Numa Pompilius, then the official residence of the Pontifex Maximus. It was again splendidly rebuilt in marble by Cn. Domitius Calvinus after the year 36 B.C. and was restored under Septimus Severus. The building was small, since it only covered an area of about 3660 sq.ft.

It contained the sacred rooms of Mars (sacraria) and that of Ops. It it were preserved the sacred spear of the god and the sacrificial utensils of the state priests, as well as the archives of the Pontifex. But also the books of ceremonies, the calendar tablets, and the official list (Fasti) of the annual magistrates. Calvinus had the consular lists inscribed on tablets in 4 columns and on the fronts of the pilasters on the outside of the external walls. One of the triumphal pilasters with capital and inscription has been found. In the year 1872 architectural fragments were found on the Forum, which long remained without consideration, until Hülsen and Schulz drew the 10 principal portions and published them.[510] The beautiful Tuscan capital, the mutules with the drops on the main cornice were already described and shown in Art. 298; the other parts are carefully represented geometrically in the place mentioned below.[532] Some points relating to the plan of the building are given by Fig. 714, I and II, which indeed offer not much that is positive. A restoration of the superstructure in a partial view is published by Schulz.[533]

Note 532. Hülsen, p. 237, 238.

Note 533. Schulz. p. 246.

Nichols deserves much credit for clearing up the whole, so far as this is yet possible.

According to the fragments, the little building was a graceful, finely subdivided and richly decorated work of the ornament-loving Augustan period, in delicacy of details recalling the Ara Pacis or still more the creations of the early Renaissance of upper Italy.[534]

Note 534. Also compare Hülsen, Ch. Die Ausgrabungen auf dem Forum Romanum 1898 – 1902. Mitt. d. Kais. Deutsch Arch. Inst.

Röm. Abth. Vol. 17. Heft. 1. p. 62-66. Rome. 1902.

471. Market for Provisions. (Macellum).

As an assured example of a macellum must be designated the structure discovered in Pompeii and so regarded. The arrangement was introduced from Greece. The first one in Rome originated in 180 B. C. One erected under Nero is known by a representation on a coin, which shows shops in several stories and a domed structure in the centre (tholos). In Pompeii, porticos enclosed a rectangular court on four sides, on whose southern side opened a row of booths with upper rooms, before which extended wooden galleries. On the north side, the booths were beside the street, by which location the booths in which were sold provisions, were not exposed to the sun. On the east side of the building erected under Nero or Claudius is arranged a chapel dedicated to the worship of the emperor, in which stood 5 statues, of which those of Octavia and of Marcellus were recovered. On the right of this was a hall for meat and fish, on the left being a room for the sacrificial meals, not far from this being a pen for lambs. The entrance was on the west side, along which were likewise shops, before these extending a portico opening toward the Forum.

But a characteristic peculiarity was found by the tholos in the middle of the court, an externally open domed structure, whose former conical roof was indeed supported by 12 columns, that rose on square pedestals. Beneath it was found a well with a covered water pipe, into which the scales of fish sold were thrown and found in abundance. Mau[535] gives the restoration of the interior of the building in a graceful little view, that must be said to be sufficiently represented. The "Chinese" hip roof over the tholos would accord with the allied forms found on the isolated tombs of the period of Nero in Aquileia and with others in Treves. Likewise by the Alexandrian relief now in Munich (peasant with cow), the form of the roof in question is proved.[536]

Note 535. Mau. p. 87.

Note 536. Compare Springer, A. Handbuch der Kunstgeschichte. I. Das Altertum. 6 th edit. by A. Michaelis. p. 273. Leipzig. 1901.

472. Horrea. (Granaries).

In the city Plan of Rome have also been preserved the ground

plans of the public granaries, particularly of the Horrea Loliana (Fig. 715), whose erection was first carried out by C. S. Gracchus. These were storehouses for grain, wherein a store of grain was preserved by the state, in order to distribute it to the people in time of need.

The ruins of the great granaries of the Roman people were still visible in the 16 th century between the Aventine and Mt. Testaccio; yet these have disappeared, like the remains of other granaries. Bellori published in his work [537] the view given of such granaries (Fig. 716), which in spite of the "inscription "from an ancient painting" must be the product of the imagination of a later time. By the plan is definitely prominent only the great oblong atrium with columns around it, surrounded by little rooms, and these differ in nowise from those of the markets and bazaars, with which in spite of certain peculiarities must be recknoned the buildings of the Eumachia and the Macellum (the so-called Pantheon) in Pompeii, to which should be added S. Stefano Rotondo in Rome as a former macellum.

Note 537. Ichnographia Veteris Romae, cum notis. Rome. 1764.

Hülsen wrote on this subject an essay with 4 plates under the title of [538] "Di una pittura antica, ritrovita sull' Esquilino nel 1668." [539] According to this "ancient picture" P. S. Bartoli executed an engraving, which Hülsen gives as drawn reversed. From this Hülsen skilfully restored the reflection and made therefrom the ground plan, thus obtaining a correct representation of the great granaries, which were located in the plain of the Testaccio below the Aventine -- the Horrea Galba.(Fig. 717 [540]).

Note 538. In Bull. d. Imp. Ist. Arch. Germ. Vol. 11. Year 1896. Fasc. 3.

Note 539. In Ichnographia veteris Romae. d. G. P. Bellori. p. 1.

Note 540. Reproduced from Hülsen, Ch. Pittura antica ritrovati sull' Esquilino. Bull. d. Imp. Ist. Arch. Germ. Vol. 11. (1896). Fasc. 3.

He understands in this case how to distinguish commercial storehouses from reserve granaries. To the former belonged the Galbiana and Loliana, which as already stated were located at the foot of the Aventine; the latter were scattered over

the entire city and served the poorer classes for safe-keeping of valuables ("in storehouses, where men deposited the most precious part of their property," and "he built public warehouses, to which were entrusted the goods of those without private custodians.").

Expressly mentioned are the Horrea Galbiana, Aniciana and Loliana.

Of the vast magazines and the emporium on the Tiber near the Aventine merely the remains of the walls have been preserved. Interesting conclusions, concerning the importation of marble that here occurred from 67 to 206 A.D., were afforded by the ancient yard for building materials located there.[541]

Note 541. Compare Reber. p. 441.

To these granaries in the city of Rome are to be added those at the extensive harbor buildings at Ostia and other places, (Fig. 718[542]), as they are represented in the drawing of the outer harbor of Claudius and of the hexagonal harbor of Trajan, protected by walls and towers -- shown as extensive colossal storehouses. An approximate idea of the structures may be obtained from the representations on coins, which afford indications of the grouping of the buildings, of the form of the harbor basin and of the lighthouse. According to these representations on coins, Canina[543] has restored the lighthouse of 4 stories surrounded by columns, later adding designs of the Emporium of Septimus Severus in Ostia, and further of the harbors of Claudius and of Trajan.[544]

Note 542. Reproduced from Daremberg & Saglio.

Note 543. Canina. Sez. 3. Pl. 155.

Note 544. On the two succeeding plates.

Chapter 21. Buildings for Public Games.

478. General.

Of state buildings erected on account of the love of the people for show, those for the public games are preserved in numerous remains; the latter are in part so important, that the original structure may be restored from them without being compelled to accept fanciful additions.

In the earliest period games were already performed on special occasions or occurrences and were established in gratitude for the manifested mercy of the gods. The most ancient games (ludi) first took place in Rome as "religious ritual ceremonies in the worship of the protecting deities."[546] Already in the time of the kings were in use the circus sports (horse and chariot races), but athletics were not excluded. After 364 B.C. were introduced from Etruria the scenic plays, which were developed by Livius Andronicus (240 B.C.) into regular dramatic exhibitions. During the republic, men were satisfied with the two first named as "state plays." Combats of gladiators, likewise introduced from Etruria (264 B.C.), were first given as unofficial and as celebrating burials or in memory of the dead; as public games at fixed festivals, they were not even held at the beginning of the imperial period and were only so arranged under Domitian. Given on the Forum during the republic, they were later exhibited in the Amphitheatre, transferred from Campania to Rome. Hunts of animals were added thereto in 186 B.C., and with increased relations with Greece, Athletic and musical contests likewise.

Note 546. Compare Marquardt, J. Römische Staatsverwaltung. Vol. 3. p. 462. Leipzig. 1878.

In time, from the originally primitive and gradually improved arrangements, complete monumental structures were erected for the games; the simplest preparations -- the leveling of a square and the utilization of natural conditions of the locality, serviceable for the purpose, such as narrow valleys or the slopes of hills for the spectators -- were succeeded by wooden buildings and those gigantic stone structures, that have partially remained to us in mighty ruins.

A part of one day sufficied in ancient times for the duration of the games; later an entire day was taken, and finally they also extended into the night with artificial lighting.

Not all games were public; Caligula, Nero, Commodus, Caracalla and Elagabalus, for example, allowed themselves to be seen at their appearances in the circus only by the court officials, or at most in the presence of the senatorial families.

a. Buildings for Circus Sports.

474. Circus.

In the time of the kings, the valley between the Aventine and Palatine was used for these sports, where the Circus Maximus[547] eventually arose, which according to Dionys had 150,000 seats and in the 4 th century held 385,000 spectators in consequence of various imperial extensions. Besides this, the Circus Flaminius (220 B.C.) was the oldest and the second in the city. Of both of the two oldest circuses is scarcely anything preserved worth mention, as well as of the later one of Nero (see the plan in Figs. 720, 721[549]) and of that of Sallust; on the contrary, of the latest one located outside the present Gate S. Sebastiano -- the Circus of Maxentius -- there are yet considerable remains, as well as of those of Bovillae (near Albano) and of Arausio.

Note 547. Compare ground plan of Circus Maximus at the foot of the Palatine, with the account of that of Augustus and of the Septizonium of Septimus Severus in Fig. 719.

Note 548. Reproduced from Pauly's Real-Encyclopädie der Classischen Alterthumswissenschaft. New edit. by G. Wissowa. Vol. 3. p. 2573. Circus. Stuttgart. 1899.

Note 549. Reproduced from Simil, A. Le Vatican et la Basilique de Saint-Pierre de Rome. Vol. 1. Pl. 2. Paris. 1882.

475. Ground Plan and Elevation.

The arena was a long and narrow area, semicircular at one end and ending at the other in a flat segmental arc. Along the sides and the connecting semicircle rose steps or rows of seats in stone; above several stories of arches, the uppermost row supported wooden or later stone porticos. In consideration of the great extent in length, a structure in the sense of the theatre and amphitheatre was not necessary. The substructure opened externally in corridors extending around it with upper stories for dwellings, booths and sale shops of the most varied kinds.

The arena was separated from the lowest row of seats by a grille and a ditch 10 ft. deep and 10 ft. wide for the protect-

protection of the spectators. The transverse structure terminating the arena was flanked by two angle towers and contained an externally emphasized central doorway for the entrance of the procession, as well as on the right and left the cells (carceres) for the racing chariots, above these being the places for the magistrates and a special box(pulvinar) for the imperial court, characterized by its magnificence. Figs. 720, 721 represent the arrangement in plan, of the steepest seats, the cells and the magistrates' loggia of the Circus of Nero, after the beautiful attempt of Simil to restore it.

476. Arrangement of the Arena.

The circus generally consisted of 3 principal parts:-- the open course (arena), the starting places (carceres) and the space for the spectators; it belonged to the grandest arrangements for sports in all time; it was the most splendid gathering place for those loving shows of all kinds. It was originally merely a fenced course, about which the people stood and watched the races. First in 329 B.C. were the permanent cells (carceres) erected in the form of gayly painted wooden booths; then occurred the enclosure of the arena by an iron grille and a water ditch. After repeated fires, the wooden booths were replaced by stone structures, and Claudius had the cells built of marble. Under Augustus, Claudius and Nero, the spectators in the circus were separated according to their positions in life, i.e., to the senators and knights were assigned special places and others for the people; the emperor Domitian built for himself a magnificent box, which was connected with his palace, but this was again removed by Trajan.

477. Circus Maximus.

What now remains of the largest circus in Rome is given by the ground plan in Fig. 719 with the addition of the adjacent buildings. We have further information concerning it from a fragment of the Capitoline Plan of the city, that shows us the semicircular end of the building, as well as from a coin of Caligula. The city Plan gives the 3-arched Triumphal Arch of Titus, the corridor with the booths, the three divisions of seats and the two concentric passages, as well as the arrangement of the steps, which are of similar form to those in the amphitheatres.[550] This agrees with the statement of Dionys (3, 68), who says in his description, that the Circus Maximus has

3 divisions of seats, the lowest of which consisted of stone steps, the two others being of wooden construction. The one-story outer corridor contained booths with rooms above them, in addition to the entrances.

The length of the course is given at 2000 Roman feet or 1935.3 ft., or including the cells, at 2083.8 ft., and the total width of 360 ft. designated by recent investigators as insufficient, who likewise doubt the truth of the statement, that the Circus held 150,000 men. They assume that the Circus under Augustus accommodated only 55,000 to 60,000 men and 180,000 to 190,000 in the time of Constantine the Great after all its extensions. Pliny gives the number at 250,000 after the enlargements of Nero; Trajan added thereto 5,000 sittings. The 385,000 spectators in the Circus in the time of Constantine are agreed to be improbable. -- The last games were held therein by Totila in 549 A.D.

478. Other Circuses.

Of the other Roman circuses mentioned, it is also now accepted that the Circus of Sallust never existed, but instead of it the Circus of the Arvals was a stone structure.

Technically interesting is the Circus of Maxentius, located on the Appian Way not far from the Tomb of Cecilia Metella, in which the concrete vaults supporting the stepped seats exhibit clay vases. The Circus was 1710 ft. long and 355 ft. wide, and it held about 23,000 men. On its axis (spina) formerly stood the obelisk dedicated to Domitian, that is now placed on Place Navona.

Still smaller was the Circus of Bovillae with an area of 1050 × 230 ft., which seated about 8,000 spectators on 6 rows of steps. Its cells were constructed of tufa ashlars.

With the great love for the circus sports, the existence of similar buildings in the provinces may also be assumed. Such are proved in Spain, Africa, Gaul (Arles, Orange, Frejus and Vienne, in Treves, Cologne, Mentz, etc.: Fig. 723 gives a view of the still remaining spina at Vienne).

Mosaics in Lyons and in Barcelona give good views of the spina with the objects exhibited thereon and scences from the races.[551]

Note 551. Representations of such structures are to be found in Daremberg & Saglio. p. 1187.

The hunting of animals and combats of gladiators, which were sometimes exhibited there, were later transferred to the amphitheatre, as previously stated.

b. Buildings for Gymnastic Sports.

479. Stadium.

The stadium and palaestra served for athletic sports. They were courses for foot races and places for exercises in boxing and ring combats, which had become naturalized in the imperial period; they were either carried on in buildings erected especially for this purpose, or these formed a part of the Baths and even of the country houses of great Romans. The stidiums frequently imitated the Grecian hippodromes or the Roman circus, in which only the spina and the cells of the former were omitted.

Nothing now exists of the famous Stadium of Domitian in Rome and only the form of its plan is still to be recognized in Piazza Navona. Of that on the Palatine, likewise dating from the time of Domitian, besides its form etc., the foundations of the enclosing porticos and the great imperial Exedra are preserved.

Later opinions prefer to recognize in these structures on the Palatine a magnificent winter garden rather than a stadium. Porticos for walks, with flower terraces and nympheums in the midst of the palaces seem more credible than a vast area of sand for a running course.

480. Palaestra.

At the greater Baths in Pompeii, the purpose of the great court as a palaestra is proved by an inscription; at the central Baths a similar one was arranged, and it is still easily recognized in the plan. The Curia Isiaca is now regarded as a palaestra, which as such consists of an oblong atrium of 484.4 sq. ft. area enclosed by porticos on three sides, and which shows a prothyron at one end with 4 additional small rooms.[552]

Note 552. Compare Overbeck. p. 150, 215, 234.

c. Buildings for Dramatic and Musical Plays.

1. Theatre.

481. Theatre.

The architectural arrangements for the performance of dramatic plays were in the earliest period equally simple as for

those of the circus. Whenever required, a wooden stage was built and again torn down; the area for the spectators was a space enclosed by wooden barriers, within which the mixed people stood and looked on. Only in 194 B.C. were arranged separate places for the senators. In 174 B.C., the censors built a stone stage and the people brought seats with them to the plays for their greater convenience. In 185 B.C., the attempt to erect a permanent theatre met with opposition; it sas torn down and sitting during the play was forbidden by a decree of the senate.

First after the conquest of Greece by Mummius was there constructed in Rome a complete theatre, indeed only built of wood (145 B.C.), and the first stone one 90 years later by Pompey, (55 B.C.); a second and third, those of C. Balbus and of Marcellus, followed in the year 13 B.C. But desides these monumental structures, the temporary theatres also continued in use during the imperial period.

482. Component Parts.

The Roman theatre building is allied to its Grecian model[553] and consists of the semicircular area for spectators (theatrum, cavea, spectacula) and the stage (pulpitum) with the scene,.

The play only occurred on the latter. A stairway led down to the orchestra, in which the senators had their seats. The rows of steps (gradus, subsellia) usually rose in an exact semicircle, divided into two or more ranges by concentric walks (praecinctiones) and by radially arranged stairs extending from the orchestra to the external circumference, into wedge-shaped sectors (cunei).

Note 553. Compare Streit, A. Das Theater. Investigations concerning the construction of theatres by the classical and modern peoples. B. The stage of the Roman theatre. t. 46 et seq. Vienna. 1903.

483. Plan.

Vitruvius (Book 5, 6) gives precise rules for the ground plan, which are explained in Fig. 724. The semicircle of the orchestra is extended to a complete circle; 4 equilateral triangles are inscribed therein, the first with its apex at the bisecting point a. The base of this triangle is prolonged outside the circle and made equal to twice the diameter of the orchestra, giving the length and depth of the wall behind the stage; the

locations of the other three triangles determine the starting points of the stairways, which are alternated between the walks, together with the axes of the middle royal doorway and the side doorways for guests on the stage. Thus the stage area is somewhat greater than in the Grecian theatre, "since everything is played on the stage," and 7 stairways lead through the first range to the first walk. At A and B the seats are cut away in order to obtain entrances to the orchestra. According to Vitruvius, the seats in the audience room should not be made higher than 16 ins. nor wider than 2.5 ft., but also not less than 2.0 ft. These should be made of equal dimensions in all theatres, whether these were large or small, the steps, walks, balustrades, corridors, stairways, the height of the stage, and the seats for the magistrates.

484. Internal Architecture.

Fig. 725 gives the inclination and the widths of the seats of a Roman theatre, which do not greatly differ from each other, although the simplest and the richest forms of their treatment do occur. At the Theatres in Pompeii and in Taormina are cut depressions behind the seats, intended to receive the feet of those sitting above. According to Vitruvius, the front corners of the seats should lie in a line m n, which fits the monuments in the fewest cases, and which fact with many others (for example, the usually greater width of the walks than that fixed by the rule) may be justified by the words of Vitruvius, that he does not desire his rules to be rigidly followed:--"The architect must know where he must enlarge or diminish in accordance with the locality and the relative magnitude."

The space for the spectators was generally enclosed at top by a portico extending around it, whose roof "should be in a horizontal line with the height of the background of the stage." (Fig. 726).

According to the theatre decree of Augustus, the lowest classes were restricted to the uppermost rows of seats, and the sexes were divided. The most distinguished places were in the two boxes over the entrances to the orchestra and directly on the right and left of the stage, where the giver of the play and the emperor, empress and the vestals sat.

1. Theatre constructed of Wood.

485. Stage.

For wooden theatres, the background behind the stage consisted of an unpainted boarded wall, which was covered by the introduction of painted decorations by Claudius Pulcher in 99.B.C.

Vitruvius distinguishes between three principal decorations of such theatres:-- the tragic scene (scaena tragica) representing a royal palace, then the comic (comica) showing a private house with windows and balconies on a street, and lastly the satiric (satyrica), that represented a landscape. The change of decorations was effected by drawing out side scenes and background (scena ductilis), behind which appeared new ones, or it was done by rotation (scaena versilis). Also arrangements for the appearing of persons in the air or rising out of the earth, and in later times, very skilful apparatus for transformations of all kinds was enumerated with the appurtenances of the Roman stage, on which were also exhibited two altars, of which that on the right was dedicated to Liber and the other on the left to the deity, in whose honor the play was given.

486. Movable Decorations.

In the description of Grecian theatres [554] were given the details relating to movable decorations, backgrounds and side scenes, machines, such as those for rolling, lifting and flying, apparatus for thunder and lightning, traps in the wooden floor, etc., and that great scenes stretched before the rear wall (or the front wall of the stage structure) were in use, as well as narrow scenes (periactes, triangular prisms and rotary scenes) placed at the sides, of which Pollux asserts that that they were partly of wood and partly of cloth and were lowered from above; again according to the evidence of Pollux and of Severus, that likewise the background was of cloth; these were stretched before the beginning of the play if possible, and they rose in front of the wall by some unknown apparatus for fastening them.

Note 554. In the preceding volume of this "Handbook", 2d edition. Notes 245, 246.

According to the authority of Reber, in the Vitruvian scheme of ground plan, the periactes were placed before the parascenes at an angle of 45°, so that each of the three sides of the prisms might lie in one plane, while Gosset [555] represents that

they stood with an angle towards the spectators. On the other hand, Streit[556] appears with a compromise and would have them placed indeed according to the method of Reber and Durm, though not before the parascenes but toward the middle on a circular arc, that forms an extension of the semicircular form of the orchestra, as indeed about as Gosset intended. We likewise hear in reference to this:-- "It is entirely inconceivable to an architect and to one acquainted with the stage, that the periactes were so long represented as rotary triangular prisms without once thinking of their upper ends. How did these upper ends look? Should the upper rotary surface have been visible, or how did they appear? Is that a termination corresponding to the artistic design? -- No indeed, -- --- etc." The "no" can only be emphasized. But does Streit really and in earnest mean, that these painted cloth decorations of the small wooden theatres were adopted without any changes in the later monumental marble proscenium of the vast monumental structures and were placed on the logeion, which in Orange, for example, was 200 ft. long, 42.7 ft. deep and 115 ft. high, in Aspendos 153.0 ft. long, 13.45 ft. wide and 78.8 ft. high, at Pompey's Theatre in Rome 335 ft. long, at the Theatre of Marcellus there 197. ft. long, in Bosra 149 ft. long, 27.8 ft. deep and 65.6 ft. high? Did men therefore ornament the costly architecture of the noblest kinds of stone with mosaics and gilding in order to again conceal it by a surface of painted linen during the play? To place a wooden floor above the monumental stage is a requirement for the "presentation of Hamlet;" but I know of no ancient piece wherein a stage above a stage would be necessary! About the middle of the last century, there were also the so-called summer theatres conducted by traveling companies, in which were again revived what Vitruvius requires for small wooden theatres. During transformations, there were dropped down over the surfaces of the prisms and likewise over the proscenium wall cloth scenes, on which were represented forest views, interiors and facades of houses. When necessary, they were again raised in 4 sections, like the painted windows and doors of modern times. But what would the theatre of the annual fair with its naive arrangement be on the marble dramatic

stage? Give to the emperor what belongs to the emperor and to God what is God's. Let the sliding scene (ductilis), the rotary (versilis), the movable background and the rotary side scenes be left to the small temporary theatres, of which it was at first stated, that they likewise remained in use in the imperial period; but do not bring them on the monumental stage; for then also shall we escape from the "inconceivability of the terminations of the rotary triangular prisms." There were they no higher than the structure permitted; they need not extend to a height of 49.0 ft. for a width of 8.2 ft. Their terminations were certainly just as appears today; concealed behind the soffits and drop. But if with Gosset and Streit, it is preferred to place them at the middle of the logeion, than to take into account an artistic treatment, it would be necessary to enclose them in a case and to furnish them with a corresponding covering, so that part of the spectators might not too soon look behind the side scenes and that the machines on the stage might be used without obstruction.[557]

Note 555. In Traites de la Construction des Theatres. Paris. 1886.

Note 556. See Streit.

Note 557. Compare the plan of the Theatre of Marcellus at Rome in Streit.

I am also skeptical in regard to the curtain question, so far as this refers to the monumental stage. It is indeed stated, that principal and side curtains were made of costly fabrics with figures woven therein, and that these were raised high before the beginning of the piece, then at the beginning being dropped into a recess behind the front wall of the logeion, and that this still appears at the great Theatre at Pompeii and likewise elsewhere. Raising it was effected by hollow supports telescoping within each other, set at regular distances beneath the podium, raised to equal heights by windlasses and then withdrawn.[558]

Note 558. Compare Baumeister, A. Denkmäler der Klassisches Altertums. Vol. 3. Munich & Leipzig. 1888. -- Also Overbeck. p. 150 et seq. Edit. 1886; -- further, Mazois; lastly, Mau. Chapter 21.

We wish to recall to mind the proportionate dimensions of different Roman stages in length, width and height, where in the following a b denotes the front wall of the podium, c d is the height of the rear wall and a c is the depth of the stage. Thus we find:--

Place.	Length ab.	Depth a c.	Height c d.
Aspendos. (Time of Aurelius)	159.5	13.45	74.0 ft.
Orange.	201.0	30.5	120.0
Bosra.	149.5	27.8	62.4
Pompeii. (Great Theatre.)	108.0	21.7	------
Rome, Theatre of Pompey.	328.0	82.0	-----
Rome, Theatre of Marcellus.	197.0	26.25	-----

The floor area of the stage is accordingly computed at about 4300 sq. ft. and the visible area of the background at an average of 10,760 sq. ft. or more. And would men operate within these dimensions the curtains, backgrounds and side scenes -- rotating, sliding, raising and lowering movements? Then in Orange or in the theatres mentioned in Rome, where were the stage scenes shoved sidewise, if "by removal sidewise" (ductiles) the backgrounds could be removed? How were the rotary prisms held at top, which still must have the height of the background, the height of a tower of a village church? They must have turned by pins in bearings at top as at bottom. How were the curtain rods 164 to 197 ft. long supported? How were these things affected by rain, wind and storm? These questions may be treated as one may wish, these arrangements may be more and more refused to the great stone theatres, or theatres within theatres must be assumed, or to do best with these, all of them may be restricted to the small wooden theatres.

It must not be forgotten here, that exactly as today, tragedies were chiefly seen by only a small and select public, which required the artistically executed representation of the localities in which the drama occurred. The popular theatres intended for the multitude must indeed abandon such intimacy, even on account of the given dimensions. The people certainly found greater enjoyment in combats of gladiators, in chariot races, the hunting of animals, or in lewd stage plays; it streamed into the amphitheatre and the circus and

thereby became unaccustomed to the high intellectual enjoyment of a finely staged and played drama. In spite of the vast stage opening, which was generally more than five times as large as those of modern theatres, the theatre did not contain nearly as great a number of visitors as are commonly assumed. The seating capacity of the great amphitheatres is much over-559 estimated, and it is just so for the theatres. Friedlander gives the following numbers for the three great stone theatres at Rome. They seated:--

Theatre of Balbus	11,510 men.
Theatre of Pompeius	17,580 men.
Theatre of Marcellus	20,500 men.

While the latter, omitting the orchestra and taking the length of sittings at 1.97 ft. each, could only receive 6,840 spectators. The orchestra was generally furnished with bisellias for magistrates, decurions, etc., and it might at most seat 500 persons, so that about one-third of the numbers of men given by Friedlander would be found the correct one. For the great Theatre in Pompeii, Mau assumes 5,000 persons in the space for the audience.(cavea).

Note 559. Friedlander. II. p. 435.

2. Theatres constructed of Stone.

487. Stage.

Flanked by projecting side wings (versurae procurrentes) and with entrances on the monumental rear wall of the stage, rose in the rear the wall in 2 or 3 stories, penetrated by 3 to 5 doorways and richly adorned by columns and niches.

Thus the stage in the Theatre of Scaurus (compare Pliny,Book 36, 24) was decorated by 360 columns, partly 38 ft. high, and its lower portion with marble, the middle part with glass (mosaics ?) and the upper with gilded paneling. 3000 bronze statues found places between the columns.

Under the restrictions mentioned, Vitruvius also gives definite rules for the elevation of the stage wall, which are illustrated in Fig. 726. 560 Fig. 727 gives in accordance with good opinions a restoration of the stage wall with its connections to the area for spectators,for the Theatre in Orange, according to Caristie.

Note 560. Reproduced from Lasius, G. Die Baukunst in ihrer Chronologisches und Constructionen Entwickelung. Darmstadt. 1862-68

Concerning the sound vases of Vitruvius in theatres, everything necessary was already said in the preceding volume of this "Handbook". (2 d edition. p. 314, 315).

Behind the stage wall were generally adjacent porticos for the protection of visitors to the theatre during bad weather. It is assumed that they were sheltered from the sun's rays by a great awning (velum) supported by masts, and which was introduced by Q. Catulus in 78 B.C.

488. Porticos, Entrances, Stairways etc.

The porticos near theatres are once mentioned by Vitruvius (Book 5, 6) as "placed above the rows of steps and in a horizontal line level with the height of the stage building." It is then further required by Vitruvius, that porticos should be erected behind the stage, so that during sudden rainfalls the people might have a place to which they could resort from the theatre, and in which may likewise be convenient space for the preparation of the stage equipment, and as a model he mentions the porticos of Eumenes in Athens. Those had nothing to do with the theatre architecturally; there were also here described only the porticos above the rows of seats, These are proved by their construction in Temenos and Bosra, where 3 columns with an architrave still are standing at top; (Fig. 728[561]); they are treated as vaulted passages in Aspendos (time of Lucius Verus and Marcus Aurelius[562]) and in Perge (era of Hadrian or Trajan). The data concerning the porticos are doubtful in the plans of the Theatres of Pompeius and of Marcellus in Rome, according to Streiter, and of the Theatre at Orange, according to Caristie; they are probable but not proved. Vitruvius would have the portico crowing the theatre building regarded as promenades, and he gives his reasons therefor, as they become practical in Aspendos. But if any one furnishes these portios with rows of seats for spectators and gives such in the plan, then is this a crude mistake in the purpose of the design, and why should such an arrangement be made for the poor common people (misera plebs contribuens) elevated there, which should protect them from all accidents of weather during the play, while the great personages on the contrary sat in the open air without protection? Or would this projection at top be a compensation for the view of the stage restricted by

the columns? The question of a portico as a covered promenade is solved for those buildings, that do not stand against rocky hills, but rise as detached structures on a level country around them, as for example at the ruins of the Theatre of Marcellus in Rome and others. For these must care be taken for another kind of access for the spectators, and we have to record in them indeed the first example after the Theatre of Pompeius (begun by Caesar and completed by Augustus in 13 B.C,-- the colosseum first commenced by Vespasian in 69 A.Da and completed by Titus in 80 A.D.), in which the entrancesto the theatre were all symmetriaclly arranged and placed on the facade; there a portico enclosing the theatre received the visitors, and from it led separate straight stairways to the first walk with again others in two flights to the upper corridors; between these were arranged connecting passages on the ground level toward the orchestra with others in the upper story extending from the upper corridor to the first walk.(Fig. 729[563]). Other straight stairways led from the inner corridor to the lower rows of seats in the first range and again greater ones from the upper corridor to the second range and ended between the stepped seats thereof -- a system that was transferred to the amphitheatre and which was retained in those kinds of buildings with minor changes.(Compare the section of the theatre under d:-- Buildings for Sports in the Amphitheatre).

Note 560. Reproduced from Lasius, G. Die Baukunst in ihrer Chronologischen und Constructiven Entwickelung. Darmstadt. 1862 to 1868.

Note 561. After De Vogue.

Note 562. See plan and perspective in the preceding volume of this "Handbook".(2 d edit. Figs. 233, 234).

Note 563. Restored section according to Desgodetz' measurements of the facade, and Reber's ground plan.

These arrangements of stairways and of access required a system of the facade, which is to be designated as not an emptn piece of show decoration, but rather as an architectural arrangement resulting from necessity and from the purpose, and which by its practical value and also by its artistic form is and will remain a title to fame in the architecture of the Romans. The internal portico forming the upper promenade will

remain a beautiful addition with a slight degree of convenience; but it could not afford any amount of shade and coolness like the high corridors on the facade and between thick walls, and it may be that to the former was given a form such as in Aspendos, where not slender columns as in Bosra, but massive piers connected by arches formed the architectural termination of the interior, while the shade corridors were only adjacent behind them.

A further title to fame in the architecture of Roman theatres is found by the organic combination of the stage and audience room into an architectural whole. In this lies a characteristic difference between this and Grecian. It denotes a fact and an architectural advance, that first truly asserts itself, when the question was to be answered, how should the space for spectators be treated, if the entire building is to stand detached on a level region and the natural advantages did not exist, such as are offered by the slope of a hill.

The answer was given by the three theatres in the city of Rome, those of Pompeius (55 B.C.), of Balbus and of Marcellus, (13 B.C), and later by the theatres in Asia Minor at Patara, Perga, Aspendos, Bosra among many, especially built under Trajan, Hadrian, Lucius Verus and Marcus Aurelius -- and by what has previously been said.(Compare the bird's eye view of the Theatre of Aspendos in Fig. 730).

3. Details.

489. Awning.

The awning (vela), i.e., the cloth covering stretched over the audience room, must protect the spectators from the heat of the sun, especially in places where the auditorium (cavea) opened toward the south. This is generally assumed on the ground of the still preserved arrangments -- perforated stone corbels on the upper part of the enclosing walls and along the stage building for the reception of wooden masts --, but w which are wanting around the semicircumference of the audience room, as is the case in Aspendos and Orange. At the place last mentioned, they are indeed represented around the circular structure in the work of Caristie; but they are as doubtful as those in Aspendos, where they are given by Petersen and Niemann, not in the view but in the ground plan of the sem-

semicircular structure. Similar arrangements on the amphitheatres in Rome, Nimes, Arles, Pola and other places may here be neglected. On the great Theatre in Pompeii there still exist perforated corbels on the inside of the walls enclosing the audience room.[564], apparaently to receive the arrangment for protecting the spectators from the blaze of the sun, since on account of the position of the theatre, they had the sun in their faces and were only shaded by the stage building. Mau asserts that the Colosseum had the same arrangement, and also the well preserved Theatre in Orange, but on the exterior. This statement suffices for the Colosseum but not for the Theatre in Orange, for which the crowning of the enclosing walls of the audience room is unknown. The high antiquity of the stones for masts on the Theatre in Pompeii is moreover in doubt, and then in this respect theatres and amphitheatres are kept separate.

Note 564. See Mau. p. 132.

For Orange and Aspendos, the corbels for masts are not proved for the circular structure, .i.e., on the external wall of the cavea; on the Theatre in Pompeii, they were incorrectly placed, even if they are antique; it is therefore advisable to not deduce final conclusions primarily from them. Caristie assumes for Orange a great tent roof of cloth on the ground of unproved suppositions relating to the cavea, and he constructs for it an arrangement for hoisting this (Fig. 731), which I can accept but slightly on account of its innate probability. It too strongly recalls the linen tents of our wandering circus people; furthermore the lighting in the interior during the play in daylight could not have been very good, and on account of the great uncovered portion A B, not all rays of the sun could be kept out.

Whether awnings were provided on the theatres in the city of Rome can no longer be determined; but according to the following statement of Cassius Dio,[565] it is at least very questionable:-- "Likewise if they so desire, men must come into the theatre without shoes, which not only the judge permitted from old in summer, but likewise Augustus frequently allowed at the festal games in the heat of summer, but Tiberius brought it into disuse. Then it also first occurred, that men placed cush-

cushions for the senators, so that they should not be compelled to sit on the bare boards, and they permitted "Thessalian huts" to be carried into the theatre, so that there should be less suffering from the heat of the sun. If the heat were too great, then the Diribitorium was covered with boards and took the place of the theatre. He did this during his consulship - ---". These nobles indeed required no "Thessailian huts" if an awning existed.

Note 565. Book 59, 7; Caligula.

490. Stage Covering.

But the stage is assumed to be covered, first for similar reasons, and then also for acoustic grounds. For example, the exterior of the stage building in Orange lies directly north; the internal decorated side thus has the full sun from morning till night, while it was at the backs of the spectators. The latter were somewhat protected against the sun by the outer wall 97 ft. in height, which cast a shadow toward the audience room; therefore it required no awning, and the heat rays would scarcely have reached the floor of the orchestra and the lower rows of seats, even in the early morning and during the late afternoon. On the other hand, the poor actors had the sun in their faces for the entire day.(Fig. 732).

It was just the same in Bosra. In Aspendos, the actors had shade in the morning and sunshine from noon until the evening. The same was the case in both theatres in Pompeii. At the Thearte of Pompeius in Rome, the players had the morning and noon sun, and in the Theatre of Marcellus, the midday and evening sun!

That the stage building was covered, we have tolerably certain indications at the theatres in Aspendos, in Bosra and In Orange (Figs. 733, 734), where the inclined junctions of the roof still exist on the side walls of the stage, but especially in Bosra, where they are certainly marked by covering stones, while this only appears in Aspendos and Orange by slots in the masonry. In Orange are also arranged in the stage wall stone water-spouts for rain water, from which one may assume the eaves of a roof surface lying behind them.

Commenced by Caristie and starting from an antique architectural model exhibited in the Capitoline Museum at Rome, there

now assumed the inclined coffered ceiling over the stage (Fig. 727), corresponding to the slots and the water spouts, and generally on the pictured representations with an impossible position of the sun. Caristie strengthened the possibility of his views by the contribution of a structural drawing (Fig. 733), supported by the aforesaid slots and the eave gutter cornice, whose trusses have a firm support on the notched front wall and in recesses of the rear wall. The trusses have a length of 54.8 ft. and according to the projection from the internal decorated stage wall, they have a free length of 38.2 to 43.4 ft. and are spaced for a distance of 201 ft. at a height of 118. ft. above the floor. What kind of a protection against sun, wind and weather may have been afforded to the actors by this position and form of the ceiling! -- Indeed none whatever! Thus the construction of the ceiling could have here been based upon only purely architectural and acoustic grounds. The authors of the drawings of the Theatre in Aspendos assume that the water from the roof a b c (Fig. 734) flowed directly through the windows and ran down on the masts, which are here set in the middle of the window openings. This purpose of the windows is scarcely to be regarded as assured; rather must they have been exit openings for the laborers at the masts.

491. Masts.

Then for what purpose were the masts and their monumental fastenings? They still exist in Orange; but as previously stated, their arrangement is restricted to only the long rear side of the stage wall; they cease at the ends and are not continued on the small return; on other portions of the wall and especially on the circular structure, they can no longer be determined. They similarly terminate in Aspendos at the angles of the rear wall of the stage, but reappear on the rear wall of the stairway towers, while they are doubtful on the circular building, as in Orange.[566] There are in general no mast corbels shown in Bosra nor on the circular structure; their limitation to the outer side of the stage wall permits the conjecture, that they should serve only for the covering of the stage and not for that of the audience room, consisting in aiding in the possibility of the strength of the inclined ceiling and of the roof of the stage. In the various theatres,

the front edge of the stage ceiling was self supporting for 108.0 ft., 148 ft., 157.5 ft., 200.0 ft., and 328.0 ft. for a projection up to 39.4 ft, thus without any vertical supports. Accordingly it was necessary to proceed as we are now accustomed to do in case of iron projecting roofs, i.e., to hang the eave or here the crowning cornice at different points to fixed supports at the rear, which might be by tensile rods from the outer ends of the trusses to the masts.(Figs. 723, 724). And if we substitute for the permanent ceiling one of cloth supported on rods extending to the upper longitudinal timber and supported by the masts, and which must be assured against deflection and variation; then the explanation of the stone corbels and the masts at the places indicated becomes even more easy. Then the great number of the similar consoles for masts would appear justified, while Caristie considers in his drawings only 6 of these on the right and left of the middle axis. For the lower consoles in which the masts were inserted it may be said, that the supporting surfaces in the holes were also furnished with a small opening at bottom, in order to provide an outlet for the water running down the masts, thus preventing the too rapid decay of the ends of the masts.

Note 566. See Petersen & Niemann. Vol. 1. Plates 20, 21.

In conclusion, let everything represented in Fig. 735[567] be included, the view of the ground plan given for the Theatre at Orange, which in the restoration shows the stage buildings, the audience room with the problematic portico, as well as the external flight of steps leading to the space for the spectators built against the side of the hill.

Note 567. Reproduced from Lassus.

d. Examples.

492. Theatre of Marcellus at Rome.

It may be told concerning the theatres in the city of Rome, that a portion of the ground plan of the Theatre of Marcellus, so far as it relates to the stage, is preserved in a fragment of the Capitoline Plan of the city, which is published in the papers mentioned below,[568] while for the audience room the ruins on the site afford some conclusions, both for the facade and for the plan.

Note 568. Reber and Streit.

Desgodetz[569] gives the ground plan with the remark, that he has not been able to measure it himself but copied it from a very old plan, borrowed from a friend in Rome; this was measured by the architect, who built the palace, which once concealed the Theatre. Serlio gives a plan differing but slightly from this plan. Both representations are impossible and incorrect; on the contrary, that published by Streit[570] is to be accepted as drawn in agreement with the marble fragment. Serlio further says for his plan, that the "rare architect Baldassare Sanese" was employed by the Massimi to measure the ruins of the Theatre, and which he also executed "with good diligence." Serlio was at the same time in Rome, saw and adopted a great part of this. He likewise published in his book the Theatres of Pola and of Ferentino.[571]

Note 569. Desgodetz. p. 126.

Note 570. See Streit.

Note 571. In Libro terzo d'Architettura di Sebastiano Serlio, Bolognese. p. 70, 72. Venice. 1584.

493. Other Theatres.

Of the Theatre of Pompeius, the entire plan of the stage and of the audience room has been made known to us by a fragment of the Capitoline Plan.[572] "Evidence of the splendor of the Theatre is not alone afforded by the statements of the ancients, but also by the Capitoline Plan, that shows the stage adorned by a forest of columns." At the rear of the stage were adjacent extensive and magnificent porticos, whose extent and form are in part known from the plan mentioned.

Note 572. Published in Reber. p. 229.

Of the provincial theatres, that in Timgad (Africa) may be mentioned on account of the good preservation of the lower rows of seats and their parapet wall with three steps placed before it, as well as that of the substructure of the stage, and it is represented in Fig. 736.

More important that those ruins is the Theatre at Bosra, still preserved in very important remains, some of which were published by De Vogue. It has recently been accurately measured and illustrated by von Domascewski and Brünnow in all its details, explained by an excellent scientific text.[573]

Note 573. To the goodness of Professor Dr. von Domascewski

in Heidelberg I owe the possibility of an early publication of the ground plan and section of this very interesting building, which present only a small portion of his extensive materials relating to it, and which will soon appear.

The Theatre has three ranges, the number of whose steps diminishes with the height of their location. Wide concentric walks separate them, from which the seats of the uppermost range may then be reached by flights of steps at the sides. The front walls of the enclosing walls of all the ranges are penetrated by doorway openings, that afford direct access to the corridors. Parallel to the walls mentioned are built somewhat lower front walls, behind which are found the narrow ascending stairways in two flights, that lead to the radial stairways separating the rows of seats.

Technically notable are the substructures of the stairways, that partly consist of inclined tunnel vaults and partly of stepped semicircular arches placed transversely and side by side, like the construction in Foret de Retz.(Fig. 737). The corridors are constructed in three stories in the audience building, avoiding cross vaults in the forms of ceilings. The inner corridors next the audience room (cavea) find their ending in architectural extensions at both enclosing walls, that are perpendicular to the parascenium. Their angles are marked by two each border pilasters, set one above the other and with capitals of the Corinthian order; the wall surfaces beneath the blind colonnades are each animated by 3 niches. The Parascenes are penetrated by rectangular and semicircular openings, the scene is subdivided by 3 great semicircular niches, that were once richly ornamented by columns.

De Vogue states that 3 columns of the inner portico are still standing (Fig. 728), while the new photographic views of von Domascewski show but two covered by an architrave. On the inner side of the external enclosing wall of the stage structure and placed next the space between this and the stage walls, there are arranged consoles at distances of 4.96 ft. and about 29.5 ft. below the roof cornice, which may perhaps have served to receive masts for shade awnings, but they may also have been parts of a gallery. If the former be assumed, they were not very properly arranged, as at the Theatre in Pompeii. The slo-

sloping walls of the parascene (Fig. 737) are evidence of the former existence of a covering for the stage, 27.8 ft. deep and 149.5 ft. long.

At the Theatre in Aspendos, the profiling of the seat steps shows an advance in regard to more convenient sitting; they permit drawing back the legs, which was likewise attained in Bosra by a somewhat changed form of detail (Fig. 737). The upper ending of the walls of the stage building and of the audience room is not certain in all parts, but is still made probable in the section.(Fig. 737). The position of the columns of the inner portico commences directly behind the upper balcony (maenianum summum), and that corresponds in its proportions to the statements of Vitruvius, who desires to have the portico about as deed as its height, if it is to have sense and dignity; it is likewise in good proportions to the other internal architecture; it in nowise detracts from the effect of the interior.

The use of movable seats in the portico is excluded as a matter of fact; likewise is absent any indication of this on the external facade. They were rather entirely concealed by the third or uppermost corridor before them and disappeared behind its vaulting. The external architecture ended with an attic of moderate height. The likewise compulsory resulting arrangement of the covered inner portico behind the front vaulted corridor of piers affords to us instructive starting points for the technical extension of such designs. The plans of this Theatre are shown in Figs. 738, 739.[574]

Note 574. Reproduced from a drawing by von Domascewski and Brünnow.

494. Covered Treatre; Theatrum tectum at Pompeii.

The semecircular structure, that we have heretofore found appearing on the exterior of the Roman theatre, indeed chiefly on account of the particular form of the site, that required a reduction of the plan, as for numerous Greek theatres. (Delos, Pergamon, Athens, etc.). But another compulsory reason might be the impelling cause, like the case of the little Theatre in Pompeii, where it concerned the construction of a roofed theatre (theatrum tectum), where all parts must be brought under a roof. Such a one Gaius Quinctius Valgus had

built there about 80 B.C. Thus beside a great open theatre was a smaller covered one -- which was not unusual, according to Mau. In such were also the movable decorations mentioned in Art. 486.

The entire covering of the stage and of the audience room required a shortening of the normal ground plan, if the construction of the roof were not to cause much trouble and expense. To make it possible, "with a shortening of the upper rows of seats -- only the lower ones formed a complete semicircle -- in order to include the entire building -- audience room, stage and dressing rooms -- within a rectangular form of ground plan." A gable roof with a gable in front and a conical hip roof at the rear, or one with hip roofs at both ends, formed the protecting termination at top. The audience room seated about 1500 persons, thus as many as the modern court theatres in the small German residence cities or in larger provincial towns.

495. Theatrum tectum at Aosta.

A conformable plan is also found in Aosta (Fig. 740), but where the facade of 158 ft. that of 89 ft. by about 69 ft. Conclusions concerning the former external treatment may be deduced still from the lofty and massive external walls. They are strengthened by buttresses to increase their stability, while the wall surfaces between these are animated by 4 rows of arches and window openings, which exhibit at the ground level round-arched doorways, above which are grouped triple rectangular windous, and over these are triple narrow round-headed windows, finally having great round-arched openings (Fig. 741) 8.2 ft. wide. Through the latter indeed came abundant and strong light into the interior of the building. The ashlars have bosses projecting 5.9 ins. without marginal drafts and are of conglomerate stone, jointed in the finest manner without mortar, and they have an average height of 2.95 ft. The walls are 71.2 ft. high; the lower arches have a clear span of 8.5 ft. with a distance of 22.3 ft. between axes.

Palace Pitti in Florence, which like the facade of the Theatre in Aosta is built without ornamental members and with the omission of all decorative details, measures 77 ft. high in its 2-story portions, and it is therefore but little higher

than the antique building in the Dora valley, whose masses taken generally may have had as massive an effect in the grand Alpine scenery as those of the colossal Florentine building mentioned. It recalled that to me. Had Master Brunellesco any inkling of such ashlar architecture in his native country, of the Theatre in Aosta, whose ground plan likewise charmed one of the greatest masters of the modern period -- Gottfried Semper -- to "reinvent" it, as it is now preferred to call this? Does it yet recur in the designs of the Festal Theatre in Munich, or the new City Theatre in Vienna, and was it not adopted in the Wagner Theatre in Bayreuth and on the Prince Regent Theatre in Munich? Everything reappears!

496. Sprinklers.

For the greater pleasure of the people, Pompeius conducted water into the theatre in order to lessen the heat therein; sprinklers with fragrant liquids were later placed in the interior.

497. Double Theatres.

A peculiar undertaking in the domain of theatre architecture was the Theatre of Curio, "who erected two very spacious theatres of wood beside each other, one of which was balanced and rotated on hinges; when plays were given in both during the forenoon, they were turned from each other, so that the stages might not be reciprocally disturbed by noise. Then they were suddenly turned around so as to stand against each other, and if the day were already declining, when the paneling was removed and the wings were brought together, they formed an amphitheatre for giving combats of gladiators, after the far more enthusiastic Roman people had been moved around. When the hinges had become weak and failed, he changed the affair, while he retained the form of the amphitheatre."

498. Circus and Theatre.

If in the early period, the wodden theatre frequently found place in the circus, we see the allied conditions likewise retained in even monumental structures to a certain degree, for the theatre and the circus were often connected together or at least placed close beside each other. In Pessinus[575] the Thetre stood at the middle of the larger Hippodrome; in Orange the Theatre and the Circus have their longitudinal axes parallel

to each other; In Aizani the Theatre adjoined the end of the Circus and lay on the same main axis.

Note 575. Compare Part II, vol. 1. (2 d edit.) of this "Handbook."

499. Entrances and External Architecture.

The entrances to the ranges were dependent upon the shape of the site on which the structure was built. If this was on the slope of a hill as in Orange, then steps placed against the external enclosing wall provided access to the upper range (Fig. 735); if it were erected on a plane site and detached, then vaulted substructures were necessary to receive the step seats, through which men passed to the upper ranges by means of straight stairways. These substructures opened externally, as in the circus buildings, into well lighted and protecting corridors, and this arrangement produced an architectural facade, effectively and uniformly animated and subdivided in its masses, architecturally bold and richly effective, which was foreign to the Grecian theatre. In several successive stories above each other were arranged arches next to arches, separated from each other by half columns or pilasters, spanned by horizontal architraves, friezes and cornices. To the Tuscan order in the first story succeeded the Ionic in the second and the Corinthian in the third in the most beautiful gradation.

500. Well Preserved Examples.

The noblest external architecture in this respect is shown by the Theatre of Marcellus in Rome, built of travertine ashlars. With the largest are reckoned the Theatre in Ornage, characterized by solid ashlar masonry, and with this is classed the Theatre in Taormina, constructed of brick and marble and at least in part Roman. Otherwise are also to be mentioned on account of their more or less good preservation:-- the Theatres in Saguntum, Arles, Pompeii, Herculaneum, Tusculum, Fiesole, Philadelphia, Petra and Gerasa (in Syria) etc.; also the Theatre (Odeum) of Herodes Atticus in Athens may be placed here.[576] Concerning the Theatre of Pompeius and its adjacent structures, a fragment of the ancient marble Plan of the city of Rome supplies abundant conclusions.

Note 576. Compare Part II, vol. 1 (2 d edit.) of this "Handbook."

501. Odeum and Auditorium.

501. Odeum and Auditorium.

In the last period of the republic were already common partly and entirely musical performances after the Grecian manner. Wealthy private persons had special auditoriums or halls for poetical and musical competitions, and it is believed, that such an auditorium should be recognized in the oblong Hall with semicircular exedras and seats in it rising in the form of an amphitheatre, discovered on the Esquiline (in the year 1874)[577] As periodically recurring festal plays were introduced musical plays by Nero (60 A.D.) and again renewed by Gordian III. The highest appreciation won by the Capitoline Competitions (agones capitoline), established by Domitian and celebrated each 4 years; he caused to be built on the Campus Martius for musical performances a special covered Theatre -- the Odeum --. Otherwise every small theatre covered by a roof, and which served as a concert hall, was designated by the same name of Odeum. (Suetonius. Dom. 5). As the best preserved example of such may be considered the previously mentioned Odeion of Herodes Atticus in Athens.

Note 577. Compare plan and section of it in Reber. p. 489.

d. Buildings for Sports in Amphitheatres.

502. Historical.

From the earliest period of the Roman colony dates the Amphitheatre in Pompeii, erected by Valgus and Porcius according to an inscription, and which is regarded as the most ancient of all those remaining or proved by written statements.

"But not from Rome did the impulse for this building come to the colonists," as Mau states.[578] Earlier and stronger in Campania than in Rome was developed the passion for gladitorial combats. Strabo's statement, that gladiators were then present at feasts in greater or lesser number according to the rank of the guests, refers to the period before the war with Hannibal, while it was an event for Rome, that in the year 264 three pairs fought on the Forum at a funeral, and 22 pairs in the year 216 on a similar occasion. There were thus much earlier in Campania special buildings for such exhibitions than in Rome, where at Caesar's combats in 44 B.C. the spectators sat on wooden scaffolds, and only under Augustus in 29 B.C., nearly 50 years after the era of Vulgus and Porcius, did Sta-

Statilius Taurus erect the first stone amphitheatre. It is assumed that in Capua was an amphitheatre even earlier than in Pompeii; the one still preserved there is much later."

Note 578. Mau. Chapter 30. p. 196.

Vespasian erected a second amphitheatre in Rome, which Titus dedicated and Domitian completed; the Colosseum that yet exists in mighty ruins and which once held 40,000 to 50,000 spectators. The first one was destroyed by fire under Nero, and besides this there existed in Rome in the time of Constantine only one other, the Amphitheatre Castrense, whose external walls are built into the existing city wall and are constructed of well shaped and finely jointed bricks.

503. Structural Plan and Construction.

The structure was divided into two principal parts, the oval (elliptical) space for the sports or arena, and the rising space for spectators, radiating around this with its stairways and corridors. The elleptical form of the building was also retained externally in the outer elevation, which was subdivided by arched openings, rows of columns and of pilasters. The seats ascended in ranges separated by walks, and which were again subdivided into blocks (cunei) by stairways. The ranges were termed "maeniana" and the lowest one was intended for knights, the middle one for citizens, and the uppermost for women. There were added in imperial Rome next the arena a box for the court, for high officials and the vestal virgins, who had their entrance through the middle portal on the longer side of the building; these entrances were specially ornamented and distinguished, as for example at the Colosseum, by stucco decorations on the vaults, which are still preserved. The seats were constructed of limestone of the most varied kinds, (travertine, shell limestone and marble), or they were merely made of wood, as in the highest range of the Colosseum. Beneath the arena extended various lines of walls, which enclosed different rooms, such as dens for wild beasts, drops and rooms for the machines for transformations, canals, etc. (Rome, Capua, Puteoli and Nimes).

The uppermost range was in certain cases terminated by a colonnade, just as for the Theatres in Aspendos and Bosra; but this arrangement cannot be accepted as usual, either for theat-

theatres or amphitheatres, as already shown. Protection against the sun's rays was given to the spectators by the high walls of the building itself, by means of the shade produced thereby; a cool temperature was caused by the sprinkling of water and a pleasant odor by the scattering of fragrant fluids.

The concentric step seats were supported by walls parallel to the arena and by intermediate walls, piers, arches and vaults; massive straight stairs with landings, constructed of stone, led to the ranges; through widely opened arched corridors, frequently opening in two aisles, men passed to the former, while broad corridors led between the stairways to the inner annular corridors. The vaults were built of split stones, bricks, or of concrete masonry, or instead of these also occurred horizontal ceilings of stone slabs, as in the Amphitheatre at Arles.(Fig. 262).

504. Relative Dimensions.

The following statement may serve to give an idea of the dimensions of these vast structures for shows.

Amphitheatre at:--	Major Axis.	Minor Axis.
Capua	558 ft.	460 ft.
Puteoli	624	473
Pompeii[579]	460	345
Rome	617	512
Verona	503	404
Thysdrus	493	411
Nimes	438	333
Arles	448	354

Note 579. Whoever measured this in millimetres here may remain unknown; certainly not a practical constructor!

Of the amphitheatres preserved in notable remains may be mentioned in the provinces those in Padua, Aosta and Pola, that in Treves on this side of the Alps, of Pergamon in Asia Minor, and that of Seville in Spain. The amphitheatres in Gaul and those of Verona and Pola each contained an average of 20,000 to 25,000 spectators, while those in Campania and in the capital accommodated twice as great a multitude.

505. Colosseum at Rome.

As the grandest example must first be considered the Colosseum in Rome, of which the proverb says:-- "As long as the Col-

Colosseum stands, so long will Rome stand; when the Colosseum falls, Rome falls, and with Rome falls the world."

Completed in the year 80 under Titus and dedicated by combats for a hundred days, the building almost wholly constructed of travertine ashlars and 159 ft. high, enclosing a great arena 281 × 176 ft., has endured a varied fate within the space of 1800 years. Fig. 742 presents[580] a correct view of its external architectural treatment. Nothing problematic is to be accepted therein; its ornamentation by figures is proved by representations on coins. The lofty facade is adorned by pilasters and rectangular windows above the three arched corridors, and it has a strange and massive effect upon the widely opened substructure. Dreger[581] therefore believed it necessary to point out, "that a great portion of the existing remains only came from later additions, and that these were not mere repetitions of the ancient, but were well known reconstructions. The most important alteration in the interior consisted in the extension upwards of the space for the spectators and in connection therewith, the transforming and increase of the stairways in a great part of the building. The results on the exterior were the raising of the uppermost wall, the transfer of the masts, the omission of the battlements and shields, and thus the transformation of the general appearance."

Note 580. In geometrical drawings after Guadet, F. Etude sur la Construction et la Disposition du Colisee. Amphitheatre Flavien. Paris. 1878.

Note 581. See Dreger.

It is possible that a facade was once designed similar to those at Nimes and Arles; then, as there, it might be terminated by an attic (or even by battlements and shields as at the Tropaeum in Adamklissi), where the three concentric ranges were left in a common slope. But if the wall above the second range, which is drawn by Desgodetz up to above the lintels of the doorways, be an original arrangement, then was likewise the superstructure over the corridors, indeed in the still existing form in appearance. I must further say here that without other basis, I am of the opinion also, that a final word can alone be spoken on the ground of further investigations.

Concerning the fate endured, we learn that under Macrinus,

(217 A.D.), lightning struck in the upper range and that the fire resulting therefrom continued for three days.[582] Such a fire might find abundant fuel in the woodwork of the masts and in the wooden seats of the uppermost range, equally so whether the seats rested on stone or wooden construction. The combustible wood with stone supports of the seats and the exclusion of a wooden roof over them was previously given at over 385,520 cu. ft., and it supplied sufficient material for a conflagration of three days.

Note 582. Compare Cassius Dio. Book 78, 25. -- The lightning struck on the day of the Vulcanalia (Festival of Vulcan on Aug. 23 d) in the Amphitheatre, and it burned there in such wise, that the entire upper corridor and the lower circle went up in fire, and the other burned portions fell down. No human help, although everything was wetted, not even the rain streaming from the sky, could check it -- and the structure stood for a long time in partial ruin, so that the gladiatorial sports were necessarily given on the Stadium for a considerable time.

The restoration was completed under Alexander Severus.

Under Decius the Colosseum was struck by lightning a second time and injured by fire, as well as by earthquakes in 467 and 472. During the middle ages it served the Frangipani and the Annibaldi as a fortress.

The destruction of the work commenced in the year 1312, when it was utilized as a stone quarry. And just the greatest enthusiasts for the antique, the art-loving popes and the great architects of the Renaissance, plundered with the smallest scruples. Paul II had taken from it the materials for Palace Venezia, Cardinal Riario those for the Cancellaria, Paul III those for Palace Farnese, and Clement XI those for the Harbor Ripetta. Benedict XIV (1740 - 58) first protected the building from further plundering, when he dedicated it to the "Passion of Christ." Pius VII and Leo XII Strengthened it by buttresses. The first excavation of the arena occurred in 1813 and the second in 1871. But the uncovering of the antique pavement on the eastern side produced a good view of the best preserved portion of the exterior.

There may be added as a brief technical note, that the piers in the lower story are 7.9 ft. wide and 8.9 ft. deep, that 80 arches existed, 76 of which were designated by numbers. The

The four entrances at the ends of the axes are without them; the balustrades in the second story are 3.28 ft. high. The linear extent of all the rows of seats is computed at 68,750 Roman ft. by Hülsen, and at 1 1/2 ft. per person, -- thus 40,000 to 50,000 sittings in all, to which might be added about 5,000 standing places.[583]

Note 583. Also compare Richter, O. Topographie der Stadt Rom. p. 167 - 171. Munich. 1901.

Not all the questions concerning the structure can be answered by its ruins and can be here discussed; but place may be taken for a few of importance, and especially for those relating to its internal architecture, the arrangement of the stairways, and its shading by the awning.

The sections of the Colosseum given by Canina and Guadet completely coincide, i.e., Guadet copies Canina. Both have five ranges separated by concentric walks, while the Arval inscription speaks of only three. The three lowest ranges are separated from each other, according to the investigators mentioned,by two parapet walls each, about the height of a man, with exit doorways, while the fourth range rises above the higher parapet wall represented by Desgodetz with doors and windows. All these four ranges are assumed to be vaulted underneath, which is certainly proved for the thhee lowest ones. The vaulting under the fourth range is doubtful,and it can no longer be recognized now. The uppermost or fifth range was supported by woodwork, that bore the step seats. Before the lowest row of its seats was arranged a colonnade, as Vitruvius requires for theatres. The columns are assumed at somewhat over 26.3 ft. high and of the Corinthian order, thus they must have had a diameter of 2.63 ft. The columns supported an entablature with balustrade and a wooden beam ceiling of about 21.3 ft. depth. The beams of this ceiling rested at the other side upon elongated consoles, which Desgodetz gives in his drawing.

What Canina and Guadet here give graphically is in itself truly beautiful; but in view of the discoveries in the ruins themselves it should not be maintained, for:--

1. As already stated, the vaulting beneath the fifth range

is lighted by large rectangular windows in the external enclosing wall. But over the windows we now still see the imposts of the vaults, which are also represented by the trustworthy Desgodetz.(Figs. 743, 744). Therefore the restoration design of the two gentlemen mentioned is not reliable on this point. Likewise the elongated consoles on the external wall are represented much too high, for this uppermost moulding is at the middle of the height of the external Corinthian pilaster capital and not at the height of the upper edge of the architrave. (Compare the frequently mentioned Works of Canina and of Desgodetz, as well as Fig. 743). Thus they cannot have directly served to receive the beams. Although indeed somewhat indistinctly, Desgodetz gives the imposts of the vaults or of arches above the consoles (Fig. 743), which must be correct.

3. The lower ranges have foyer corridors, to which men might withdraw during the intermissions or the occurrence of rain squalls, and which were sufficiently large to receive the entire show-loving multitude of one range. To the uppermost range is denied a corridor by Canina and Guadet (see the section in Fig. 742), but to its seats is given a protecting roof supported by columns, under which the multitude was strictly enclosed, exposed to the driving rain and the burning sun, if they must not withdraw to the lower corridors.

The arrangements at the Amphitheatre in Arles show us, as well as those in the Amphitheatre in Pola, how carefully considered was the removal of rain water. It is indeed merely an oversight, that Canina and Guadet did not take this into account for the terrace roof assumed by them. Not once is any fall given; Guadet even covers the inner awning masts by the ceiling, whereby free passage was opened for the penetration of the rain water at the walls down to the wooden seats of the "uppermost wooden gallery." According to the form of the existing principal cornice on the building, the rain water from the protecting roof or the terrace over the uppermost gallery was led into the interior of the structure, and the great volume of water thus formed fell down upon the lower ranges.

But how was the terrace roof itself constructed! Certainly not as the gentlemen mentioned hawe represented it. If wood

was employed for it, then a covering of tiles was the only means of protecting this material from the injuries of the weather. But if one would avoid this, since the maneuvres of the sailors from the fleet in stretching the awning could not be performed well on a tile roof, then must recourse be had to a massive vaulted construction in the form of a continuous flat tunnel or annular vault with an inclined smooth covering discharging the water on the inside. Vestiges or indications for both kinds of ceiling do not exist. The entire vertical section given by Canina and Guadet is not to be accepted in its upper parts. Indications of the arrangement of such covered porticos do not remain on amphitheatres, so far as I know, and they are unusual, from which I except those in Verona and Pola, which, according to the arrangement of the cornices and the consoles of the inner side of the outer wall, must have had such, while they are uncertain in Rome and most certainly never existed in Pompeii, Nimes, Arles and other places. The acceptance of porticos is based on a statement of Vitruvius, who requires such for theatres, while he is entirely silent concerning amphitheatres. In the Theatres of Aspendos and Bosra (Fig. 737), they still exist; there may have been such in Orange, which would indeed be regarded as necessary there in particular, where the Theatre was built against the precipice of the hill and the arrangement of corridors for the different ranges was impossible. At the Theatre of Marcellus we find the corresponding ranges, since a detached structure comprised the corridors with the covered stairways and entrances, just as for the amphitheatres.

506. Reconstructions.

What portion of the Colosseum yet stood at the end of the 17 th century was fixed by Desgodetz in 1682 in his work on the antique monuments of Rome, a work that in 1779 -- thus 100 years later -- passed through a new edition! The observations and measurements of the sensitive and learned architect, whom the great minister Colbert generously supported in his studies, are and continue first to be the most reliable, that we have concerning the antique architectural monuments of Rome, if indeed the purely technical side of the work no longer entirely satisfies our modern requirements. Fig. 743 is made

from the measurements of Desgodetz and reproduces the scheme for the internal elevation of the structure, as well as the corresponding section. The portions still remaining are indicated in black; those in outline give an attempt at a reconstruction of the internal elevation. The stepped structure affords only three ranges besides the lower podium -- the first range, the second range and the uppermost wooden range, all with double corridors before them, and indeed in the first and second ranges are two behind each other with a doubled concentric passage at the height of the uppermost step seat., that terminates internally with a wall only penetrated by rectangular doorways and small windows. The uppermost range, on the contrary, has two corridors above each other, accessible from the lowest and uppermost seat steps. As for the lower ranges, the upper corridor terminates on the inside with a stone wall furnished with doors; this receives a colonnade, which again supports a terrace roof, as Canina and Guadet desire. The columns there become 18.0 ft. high with an average diameter of 1.84 ft., and thus are smaller than those assumed by Canina and Guadet, but perhaps harmonize better with the whole than there. With these lesser proportions of height, the porticos also better fulfil their purpose; they afford protection against the sun and against driving rains, which would not be the case for great height. The flat terrace roof with a fall towards the interior and with a width of 14.8 ft. may and can be left for occupation by the sailors entrusted with stretching the awning, and who could also see the play from thence.

Fig. 745 presents us with another restoration, which was made by Knapp and Hülsen. It coincides in the two lower ranges with that designed by Desgodetz, but it differs substantially from that in the upper parts. The uppermost gallery is not of stone, but is rather assumed to be constructed of wood, with reference to the Arval inscription, which dates from the earliest period of the building and designates the places therein assigned to the society of the Arval Brothers. 584
It speaks of a first range, a second range above and "an upper one in wood." To the two first ranges men passed from the upper corridor and from stairway openings in the mid-height of the rows of seats, whereby each range was certainly divided

into an upper and a lower one.(Compare the dotted lines in Fig. 745, that indicate the stairway lines). The uppermost gallery of wood is represented by Knapp and Hülsen as separated from the uppermost row of seats.

Note 584. Concerning the Arvals, see Roscher, W.H. Ausführliches Lexicon der Römisch-Griechische Mythologie. Vol. 1. Abt. 1. p. 974. Leipzig. 1884-6. -- And in regard to the Arval inscription:-- Hülsen, Ch. Il posto degli Arvali nel Colisseo. Bull. Comm. Arch. Com. di Roma. XXII. p. 312 et seq. -- Also Dreger, M. Das Flavische Amphitheater in seinen ersten Gestalt. Allg. Bauz. 1896. p. 56.

585. Baedeker, K. Mittel-Italien und Rom. 13 Auflage. p. 278. Leipzig. 1903.

Note 586. Compare Petersen, E. Vom alten Rom. p. 60 - 65. Leipzig. 1900.

Knapp and Hülsen desire to protect the wooden rows of seats of the upper gallery from injuries by weather and also to ensure the women sitting there a protected place during the games, certainly at the expense of good vision, which was not a littel hindered by the columns, 2.46 ft. diameter and set 16.4 ft. from centre to centre. For the height of the protecting roof, 24.6 to 26.3 ft. from the floor to the lower edge of the architrave, and for the small depth of only about 16.4 ft. for the rows of seats, the protection from rain, sun and wind would indeed have been generally quite small. The corridors behind this uppermost gallery are assumed to be vaulted, which corresponds to the facts at the building; but the terrace roof consists of woodwork and forms with the adjoining vault terrace a level floor surface 39.4 ft. wide. The collection of rain water would here be extremely great, which would only be properly carried off by a considerable fall of the floor surface, but which is not foreseen in the drawing. To this area, that receives more men than the second range, were the people sent, who were not provided with festal clothing, the poor common people (misera plebs)? But how many of these could have seen anything of the occurrences in the arena? Generously estimated, only the two or three foremost men, who occupied 4.93 ft. of the 39.4 ft. available. What lay behind these is useless space, which forms 56,405 sq. ft. for the entire perimeter of 1719 ft

of the elliptical building!

Furthermore only 4 stairways are visible at the structure, 587 which served the thousands as a means of ascent and descent! The elongated consoles in the uppermost extent of the wall are assumed to have been joined by arches leveled up horizontally, whereby a wider standing place or continuous gallery was obtained for the sailors of the fleet at Misenum, who performed the duties relating to the shade awning. The above mentioned four stairways are continued thither, which appears sufficient. No objection is made against this arrangement. The use of wooden masts for the shade awning is assured by the structural details.

Note 587. Compare Desgodetz. p. 109 and plate 1.

Against the arrangement of the sort of upper portico in addition to the already mentioned technical and practical considerations are further the effect thereby produced in the interior, which would be decidedly stunted. The echo from the stepped structure upward is injured; the bringing forward of the portico over an enclosed base of about equal height diminishes the internal space and makes it uncomfortable and gloomy. Remains of drums of columns and capitals, which were found in the interior, must especially have led to the assumption of the columnar gallery. Furthermore for this were collected representations on coins, on an antique relief, and the designation "tabulationes" (boardings) in a document relating to the Colosseum. Guadet publishes two such coins (Fig. 746[588]); but I cannot make out thereon with certainty an internal colonnade.

Note 588. Reproduced from Guadet.

The portico might have been omitted at the Colosseum just as well as at the other amphitheatres, whereby the effect remains simple and grand, as shown in Fig. 745. But if one adheres to one thing absolutely, then I prefer an architectural solution for the reasons given, as they are presented in Fig. 743 after Desgodetz' drawings, to such a one as offered by Knapp and Hülsen. This view may also become permanent, if the seats of the uppermost gallery rested on a substructure of wood, instead of a stone vault. Moreover, the wooden framework for the wooden seats may have been placed on a half tunnel vault -- a system of construction appearing to me more probable for many reasons than an entirely wooden substructure. (Fig. 750).

Among the great Roman masters, Who occupied themselves with the question of the internal elevation of the Colosseum, let only Sebastiano Serlio be considered, who expresses himself on this in his 3 rd Book on Architecture [589] with the addition of drawings. The latter exhibit solutions of two kinds; in one, the doubled corridors extend to the height of the external main cornice; in the other, he is satisfied by a single portico in the uppermost story; the space before this is uncovered and furnished with a continuous stepped structure. On account of the imposts for cross vaults in the 4 th story, he believes himself, that only "one" portico was built, while the stepped structure before it was intended for the common people (plebs); by this arrangement with but one portico was obtained a larger number of sitting.

Note 589. L'Anfiteatro di Roma, del Vulgo detto il Coliseo. Venice edit. p. 79, 80. 1583.

"In the midst of the poverty of Arab huts stands an amphitheatre, which is little inferior in magnitude to the Roman Colosseum" -- the Amphitheatre of Thysdrus, the emblem of Roman Africa, from the period of the dynasty of Severus.(Figs. 747, 748 [590]).

Note 590. Compare Schulten, A. Das Römische Africa. p. 34. Leipzig. 1899. -- Further, Annali dell' Ist. di Corr. Arch. vol. 9 of new series. p. 241. Rome. 1852. Anfiteatro di Tisdro. -- Then, Dreger, p. 59. -- Also, Gauckler, P. L'Archaeologie de la Tunisie. p. 51. Paris. 1896. Amphitheatre El Djem. (Thysdrus).

Pasquale Coste made the first measurements here in 1835 and gave a cross section of the building, which is reproduced by Dreger. [591] Coste remarks thereon:-- The exterior is well preserved, the interior is filled with ruins and sand. No ranges or seats now exist. The stairway vaults still exist, but without the steps. And Gauckler said in 1896, that the interior had suffered greatly; the steps of the stairs were torn out and the seats had disappeared; yet the whole presented a grand appearance. Yet this makes us no wiser. According to Coste's drawing, the building is surrounded by only a single corridor in each story. The stepped structure in the interior consisted of two great ranges and the smaller uppermost range, which

here did not rest on a wooden, but rather on a stone substructure. A fourth arched passage is formed at the height of the uppermost row of seats, that received its light through small windows in the internal wall, from which it must follow, that the elevation presented an entirely solid wall surface above the 4 th arched corridor, merely animated by pilasters, it being assumed that a portico with terrace roof was placed over the fourth passage mentioned. Or the structure terminated with an attic of moderate height, if another range was arranged without a protecting roof. In harmony are given columns between the arches, Corinthian for the 1 st story, Composite for the 2 nd, and Corinthian again for the 3 rd. From the ashlar construction without mortar of the approximately second largest of this species of structure in the broad Roman empire, in spite of the relatively good preservation of its external walls, we can obtain no final answer to the question of the internal construction of the Colosseum. And this must remain unanswered, so long as investigations are not undertaken on a greater scale, or the necessary discoveries are not made otherwise. The ruins now attainable by ordinary mortals tell us only what is generally known.

507. Stairway Plans.

An important structural question is raised by the arrangement of the stairways in these impressive public buildings, that received thousands of persons loving the performances, and we must here confess again, that the ancient masters solved this problem skilfully and in a grand manner. The stairways frequently lie uncovered, and according to the local conditions are either arranged to ascend adjoining the exterior, as in Pompeii (Fig. 749 [592]), or as in Pola, where four separate stairway towers are attached to the 4 quadrants of the ellipse.[593] In Pompeii are preserved straight stepped staircases in two flights with landings, the width of the stairway hall being 7.06 ft. wide, and which extend to the uppermost story. Likewise in Pompeii 4 stairways sufficed, for 2 external double stairways led to the ranges and 2 single ones to the terrace.

Note 592. Also compare Mau. p. 196 et seq.

Note 593. Compare Stuart, J & N. Revett: Die Alterthü"mer von Athens. Vol. 2. p. 619, pl. 1 - 14.

Darmstadt. 1881. -- (Also English editioo of the same).

As a rule, there is required the arrangement of a great number of flights of steps, which are arranged partially between the rows of seats (see the plan in Fig. 746), and which terminate at the concentric walks and the porticos. The steps are placed in single flights with landings and between the diverging division walls. Winding stairs were not constructed.

On the grandest and most complete scale were constructed the stairways in the Colosseum, even if they show a deficiency in the third story, which can scarcely be made good again satisfactorily. To the podium (Fig. 746) led from the street 16 straight stairways without landings, with perhaps 4 others at the ends of the major and minor axes of the ellipse, which are now destroyed. There likewise extended from the street to the first range 16 straight flights with no landings, which terminated between the rows of seats in their lower third, and which were accessible from the innermost elevated gallery. This passage received light and air in part from the walk, that separated the first and second ranges. (Fig. 745). The spectators must descend to the lowest places in the audience room or ascend to the upper ones. But a second arrangement of stairways also led to the doubled corridor II, from which one could pass to the concentric walk of the first range. The spectators that used this, which were the greater number, must then descend again to their seats. These second stairways were accessible from the lower double corridor and comprised 4 flights with solid intermediate walls and 3 landings. The middle landing received light and air from the inner corridor lighted from above, already mentioned. 20 stairways in two flights with landings led to the second corridor. But the latter was further reached by 16 additional straight stairways with landings, that were entered from the inner corridor with skylights; these were continued in straight flights without landings, which opened in the lower third of the stepped seats of the second range. Visitors to the second range must therefore have descended again to their seats. But they had another means of access, which they reached by flights with landings; this was from the corridor before the small entrance stairways to the first concentric walk, and it ended in the front aisle of the

doubled corridor III (Fig. 745). From thence men passed through the rectangular doorways in the dividing wall, which rose behind the second range, to the concentric walk therein. The spectators were therefore in part again required to descend to their places.

These arrangements are proved by the drawings of Desgodetz and may yet be recognized today, being in part still usable. But in the doubled corridor III (Fig. 745) occurs a gap in the connection between corridors III and IV. Desgodetz represents (Plate 1) on the ground plan of the III order only the 16 exits for the stairways leading to the intermediate story of the II order, and besides these the 40 rectangular openings for lighting the intermediate story in question. He gives the inner piers of the double corridor III only in outline,"because they are destroyed."

Then how were formed the stairways to the floor of the single corridor IV? Different assumptions were made for them, the most acceptable of which is perhaps Guadet's; it may be seen in the ground plan in Fig. 746 and in the perspective section in Fig. 750.[495] From the model of the stairways for access in the Amphitheatre in Pompeii, Guadet places before two piers and an archway a straight stairway with landing, and he thereby creates the possibility of reaching the floor of the single corridor IV, and at the same time, that of passing to the lower stepped seats of the uppermost range from the landing by means of a branched stairway. For this case is then certainly necessary a second stairway behind the middle pier, as shown in the illustration. If a wooden substructure be assumed for the range, and in view of the relatively small number of stepped seats therein, these rear stairways might indeed be omitted. But the stairs to the corridor IV must terminate therein, and this ending cannot be placed below the wooden substructure of the uppermost range; but the stairways themselves might be located behind the piers or even at the inner wall, and an ending created for them, about as arranged in Fig. 750 for the corridor II. The architectural form will thus not be disturbed by doubtful projecting stairway structures. But men passed to the upper concentric walk of the uppermost range by authentic stairways, and they then only had to descend to their

seats, as in the first and second ranges.

Note 595. Reproduced from Guadet.

What further follows again rests on the secure basis of Desgodetz' drawings and on the existing projections from the walls. 24 stairways in three flights each represent the connection between the single corridors IV and V, as shown by Desgodetz (Fig. 743) and which are repeated by Canina in a perfectly correct and appreciable manner.(Fig. 394; my own sketch). The connection of corridor V with the terrace roof VI and from thence with the gallery supported by corbels was effected by 4 straight stairways along the external wall, whose vestiges and remains were still drawn by Desgodetz (Fig. 743). In a similar way and according to the same system were arranged the stairways in the Amphitheatres at Nimes, Arles, Verona and elsewhere, as shown by the sections drawn in Figs. 764 and 758. These stairways mostly had no pleasant rise of their steps and not so good a proportion of rise to tread, such as the Renaissance masters,(for example in Palace Farnese at Rome) and modern practitioners have computed; on the contrary, the risers are chiefly made too high for the treads. At the Colosseum, for example, the ratio is 8.5 to 12.75 ins.(Fig. 745). In the same structure the steps were in part moulded, while in other places they were merely dressed smooth with a rectangular section.

The stepped seats generally have a height of 15.9 ins. or somewhat more (Fig. 758; Amphitheatre at Verona, as seen by Desgodetz) and a seat 28.0 ins. wide. 17.7 ins. suffices for the seat; but opportunity must be extended for those sitting above to place their legs there, which required a widening of the seat surface by 9.8 to 11.8 ins. These requirements explain the dimensions of the seat steps. The inclination of the corners might indeed be made somewhat less, if more space were allowed for the legs of those sitting above, in order to avoid reciprocal loading (crowding); but the height of the seat could not be lessened and the width of a sitting could not be reduced beyond a certain measure, without producing unbearable inconveniences. Rows of seats drawn too steeply, as we frequently find them in restorations, are therefore to be rejected. Serlio in his description of the Colosseum permits

the stepped seats to join together in a complex manner (Fig. 745), which has the advantage, that rain water could not penetrate into the joints. According to the numerous and just criticisms, which Desgodetz makes for the Renaissance masters mentioned and even the great Palladio in their measurements and illustrations of antique buildings, one may also be skeptical about this statement. The masters of the 15 th and 16 th centuries accepted the works of the Romans in general and neglected the smaller things therein.

Desgodetz states in relation to the form of the seat step in the Amphitheatre in Verona -- those now existing are known to be of later date --, according to which the seats slope to the front and only show narrow horizontal edges at the end joints. The seat steps in the Amphitheatre at Arles have a narrow reversed surface for the feet of those seated above (Fig. 751), as they are given for the Theatres in Taormina and Pompeii. We further find in Arles also square bosses with holes in the front side. The guards at the building explained them as arrangements for fixing arm rests, while they were actually merely workmen's marks still remaining.

508. Arena.

Beneath the board floor of the arena covered with sand were subterranean rooms in the great amphitheatres, that served for a great "decorative arrangement," as shown by the Colosseum and the Amphitheatres in Capua and Puteoli (Figs. 752, 753), while they are wanting in smaller ones. For example, in Pompeii is found no vestige of such substructures. They consist of 3 elliptical passages in Rome, of a long one extending along the major axis of the ellipse, of 4 side passages running parallel to this, which are divided into small chambers. They were a- 596
gain discovered and were graphically represented by Rossini. In the beginning of the seventh decade of the last century, they were again discovered, and a portion of them remains open today. Fig. 752 gives us a good representation of the subterranean structres, the interior of the Amphitheatre at Capua, where the great central passage with its lower lying water ditch, with the parallel passages and the elliptical passages are laid bare. Likewise the interior of the Amphitheatre at Pozzuoli (Puteoli, Fig. 753) shows us the wide middle passage

and the openings to the outer and side passages.

Note 596. In Le Antichita Romane. Palte 80. Interior of the colosseum, excavated in 1813 and again covered in 1814.

509. Awning for Shade.

The visitors of the lowest range were protected from the sun by the high external walls, at least by their position during the cooler season of the year. But special arrangements were required in the height of summer, when the sun stood almost at the zenith. This could scarcely refer to a complete cowering of the interior, nor to the covering thereof with a tent roof of cloth, but merely to a partial softening of the sun's rays.

Caristie assumes for the Theatre in Orange a linen tent roof with an opening at the apex, which by means of windlasses and pulleys on wooden masts could be raised and supported. What might indeed be possible for small semicircular theatres, could not be transferred to the vast amphitheatres without changes. A tent roof extending over the entire room must be regarded as excluded on account of the difficulty of the raising and handling of such for a length of about 624 ft. and a width of 493 ft, as well as on account of the darkening of the interior by it. In the year 1869 was discovered a painting in a house in the vicinity of the Theatre in Pompeii -- now in the Museum at Naples --, which affords in a way some conclusions concerning the arrangement in amphitheatres of the means of protection from the sun's rays. We have to do with an elliptical room, which measures 460. ft. on the major akis and 345 ft. on the minor axis, ekclusive of the terrace extending around it (in contrast with 616. and 512. ft. at the Colosseum). What was true here must likewise be assumed for the larger amphitheatres in Capua, Puteoli, Thysdrus, etc. The representation in Fig. 749 exhibits to us a stretched rope, on which rests the awning, as on our great ocean steamers, that could at need be moved forward or backward on the rope; the reefed folds sketched in the picture show this. For utilizing the city wall and its towers, the awning was placed on the South side of the building; wooden masts behind the seats for the women served to support it; some perforated stones found in the floor indicate the positions of those supports. The location of the supports is

otherwise indicated at the Colosseum in Rome, and yet differently at the Amphitheatres in Nimes and in Pola. The cornice slabs are perforated in Rome, the architrave is indented and at the height of the upper third of the external wall with windows are built in corbels, that served to support and receive the masts. The principal cornice in Pola is similarly perforated, and on a lower belt course rest projecting stones, which bear the marks of the position of the masts. Attention must here be paid to the care shown in the construction in Pola, so that the wooden masts were not brought into contact with the rain water flowing from the terrace roof (Fig. 754). In Nimes likewise still exist the arrangements for the masts; Fig. 755 represents the method of fastening them, according to Choisy's acceptable suggestion. As in Pompeii, so also in Rome, Pola, Nimes and elsewhere, the awnings were hoisted on a network of ropes only so far as circumstances required, and it was shifted in accordance with the position of the sun -- reefed or extended -- also sliding, as shown by the Pompeian picture, and as we are now accustomed to do over light courts, skylights, etc., if we desire to keep out the sun's rays.

Note 597. Mau. p. 203.

"The sailors of the fleet at Misenum supplied the service of the awning." [598] from which it may be deduced, that they must continue to serve as long as the games continued, that this did not consist in stretching it once each day, that they must remain constantly in place and had to work at the awnings in accordance with the changing position of the sun. I could favor the idea, that the awning was stretched vertically between the masts, that it was hoisted or lowered only at the places where required by the position of the sun. A protection on the North or on the East and West with a rising or setting sun was indeed unnecessary from the shape of the building and with its high external walls.

Note 598. See Petersen. p. 62.

510. Other Amphitheatres.

Concerning some of the first mentioned larger structures some additional noteworthy remarks may follow.

1. The Amphitheatre in Thysdrus externally exhibits the most similarity to the Colosseum by the Arab addition above

the three corridors, whose beginning in the ancient period yet exists, both on account of its materials and its magnitude. (Fig. 748). It is built of reddish-yellow sandstone: all coursed stones are uniformly 1.64 ft. high, set with mortar joints 0.2 in. thick, for a height of 95 ft. of the building without attic, the half columns before the piers in the 1 st upper story belong to the Corinthian, in the 2 nd to the Composite, and in the 3 rd to the Corinthian again. The foliage of the capitals is merely roughed in. Bricks were not employed; all the vaults were constructed of concrete. According to Coste, 68 arches lead to the interior, according to Gauckler but 60. The ruins also still show the manner in which were constructed the vaults of the upper range, that supported the seats of the spectators:-- two flat tunnel vaults, separated by a pier or an intermediate wall, were obliquely leveled on top to receive the seat steps, that were here of stone, like the other parts of the structure. An attic with pilasters exists no longer, but merely its beginning in several courses, as previously stated. 599

Note 599. Compare also:-- Annali dell' Istituto di Corresp. Archaeol. Vol. 9 of new Series. Rome. 1852. Tav. d'Agg. U. p. 241.

2. The Amphitheatre in Pola is of elliptical ground plan, the major axis of the ellipse measuring 434. and the minor 345. ft., with a height of 96.8 ft. for the building. It is constructed on the slope of a hill, where the inclined site is considered, for it shows at the lowest point of the lower corridor even a basement with rectangular openings. The natural slope of the hill was also probably utilized in the interior for seats, whereby for almost the entire Eastern half was saved the cost for substructures, corridors, stairways, etc. In the opposite half still remain the foundations for the rows of seats and the passages, (Stuart & Revett have drawn them), in the form of very thick and massive walls, which contradicts the opinion expressed on different sides, that the interior was entirely of wood.

Four stairway projections were already mentioned, each of which contained two straight flights, whose vestiges are yet visible, and which could be entered from opposite sides. 600 Notable in these stairuays are the stone closures of the window openings, composed of marble slabs perforated in patterns.

From the external wall 72 arches led to the interior, the surfaces of the facade were partly rusticated, flat Doric pilasters divided in the two corridors lying above each other, between which were enclosed the round-arched wide openings, whose keystones alone were likewise rusticated. The uppermost corridor terminates with an insignificant cornice, on which rest the supporting stones for the masts of the awning, and above it rises the relatively high story, perforated by square windows, and which ends in a quite boldly projecting cyma, without any kind of supporting members. Above this extends a kind of attic, consisting of a number of small isolated piers with two courses of stones laid on them. The free spaces between the stone supports serve for the discharge or flow of the rain water toward the collecting gutter (cyma) with outlets, which surrounds and crowns the entire building. The masts for the awning must here be made especially long and strong on account of the prevailing storms (bora); for according to the existing vestiges, they passed through the cyma to the supporting ashlars on the cornice, through the entire height of the upper story.(Fig. 756). 601
The careful construction of the gutter with its triangular water outlets (Fig. 754), as well as the attic with its openings for water makes it probable, that the Amphitheatre had an upper gallery, perhaps in the manner of the Theatre in Aspendos, thus as Vitruvius prescribes for theatres alone. Stuart & Revett remark thereon -- and those gentlemen were well acquainted with antique art --, "that they have found no vestiges of such galleries anywhere on any ruin of this kind;" but they express the conjecture that such existed here. Fig. 757 gives on the basis of existing facts, the probable section of the Amphitheatre with a portion of its external architecture and the crowning gallery. The structure is of white Istrian limestone, and it must be referred to the time of Diocletian or Maximin by reason of its detail forms.

Note 601. After a photograph by Wlha in Vienna.

3. The Amphitheatre in Verona, whose internal arrangement is represented in Fig. 758, must indeed have belonged to the provincial buildings of medium size, that had adopted the Vitruvian gallery of the theatres as the uppermost corridor. The section gives an attempt at a solution with a gallery in one

case, without one in the other. One is strengthened in the assumption of one by the consoles projecting from the inner side of the external walls at the height of the external frieze of the cornice (Fig. 759), which must have served as supports for beams. Opposite the consoles were then placed detached pilasters, that received the other ends of the beams, even if instead of the free pillars an arched gallery was not carried around as in Aspendos. Beams and piers then received the ceiling timbers and the flat roof as there, which was inclined inward and there discharged the rain water. The flow of the water toward the interior is also shown by the peculiar cutting of the seat steps.(Fig. 758). The structure was built of ashlars of hard shelly limestone (gray limestone and reddish-yellow conglomerate), like that in Pola, and it was erected under Diocletian in 190 A.D. The facade was divided into 3 stories by simple Doric cornices with a plain and low attic, and its surfaces were animated by rusticated pilasters of the Doric order. A change in the columnar order is here indicated as little as in Pola. The pilasters of the uppermost story are connected by rusticated arches in a pecoliar way.(Fig. 758). Arrangements for awning masts are not found here. There still stand 7 piers and 6 arches of the external arched gallery, whose keystones are each in depth wrought from a single block. No attention is paid to a regular jointing of the stones at the junctions of the arches. The external piers of the arches measure (at the floor) in depth 7.23 and the inner ones 4.93 ft. The peculiarity in the cutting of the seat steps was previously mentioned. The latter have been repeatedly restored since the end of the 16 th century and are partly modern. "Most of the seats are new" said Desgodetz, to whome we owe a good drawing of the plan, a section, and a portion of the facade with the corresponding details.[602] For this building, Master Desgodetz again turns to Serlio. Verona's great Renaissance architect Michele Sanmicheli was no little influenced in his works by the rusticated treatment and the details of the antique structure.

Note 602. See Desgodetz. p. 122. Chap. 22; De l'Amphitheatre de Verone.

4. The Amphitheatre in Nimes, dating from the 1 st or 2 nd century A.D., is constructed of hard white limestone from the

quarry of Barutel (4.35 miles from Nimes), and it was sometimes ascribed to Antonine, to Trajan, to Vespasian, to Titus and to Domitian as its builder. Occupied by about 2000 men during the middle ages, it was later again cleared and was improved after 1858 under the lead of Revoil; it is now well cared for. The seats in the interior have been partly restored, (Fig. 760), since the building has been again devoted to its original purpose, for during the summer season bull fights after the Spanish custom are held on each Sunday.

With a height of 70 ft., the exterior exhibits two corridors above each other and a crowning attic. The facade of the lower corridor is 35.5 ft. high and is animated by rectangular piers without bases and with capitals resemblind Doric; that the upper one shows half columns of the Doric order on pedestals. The broad archivolts are simply profiled but have no keystones, and the principal cornice is returned above the piers and half columns, as well as the cornice about the small attic pilasters, so that the vertical subdivision of the building is thereby strongly emphasized in contrast to the structures previously mentioned, in which an accenting of this is not expressed. The building has but two stories, and considered as a whole, it would have become a widely extended mass of building, had the horizontal cornices been constructed without any returns. With a correct estimate of this fact, the architect therefore introduced the returns of the cornices, thereby giving to the structure an aspiring character for its relatively low height. Between the extended horizontals and the verticals on the building is thereby produced an equilibrium between both by means of this subdivision in a satisfactory manner (Fig. 761). The arrangement of rectangular pilasters in the 1 st and of half columns in the 2 nd stories makes the mass of the structure strong and bold below, and permits it to appear more refined and graceful in the upper part. The ancient law in architecture, the reducing of the masses upward in expression, is excellently carried out.

The attic shows 120 projecting perforated corbels, which served for receiving the masts of the awning, as already stated in reference to Fig. 755. Worthy of note are some sculptures on the northeast side, representing gladiators and the Roman wolf.

One, and indeed the northern of the main entrance doorways, 14.6 ft. wide, at the ends of the major and minor axes, is crowned by a pediment, which is supported by bulls in half height. This was originally the chief entrance to the arena, on whose 35 concentric seat steps 24,000 spectators found places. The ranges were separated from each other by 4 concentric walks, and they were likewise divided for officials, knights or citizens, women, and the common people. The acceptance of an upper gallery appears to be excluded in Nimes as well as in the neighboring Arles. 124 exits made possible a rapid emptying of the audience room. Excavations in the year 1865 showed a subterranean construction in the arena like that in the Colosseum at Rome, and the existence of a channel for water permits the possibility of the former holding of naval combats. The small height of the parapet wall of the 1 st range makes it probable, that the hunting of animals did not occur in the arena, and that this was limited to the combats of gladiators, chariot and horse races, and to nautical sports. In the split stone masonry of the substructure in the arena were found stone slabs with the inscription:— T. Crispius Reburrus made this (fecit) -- perhaps the name of the architect ? But we do not easily find at any ancient building on the Italian peninsula such stonecutter's work with the use of massive ashlars, such as are executed here in Gaul. All stones were set without mortar and with the finest joints, as in the best Grecian buildings of the time of Pericles! The structure and hardness of the stone made such work easier; but a finely trained race of workmen must be assumed, and which is in the same manner true for the later mentioned Arles.

Concerning the peculiarity of the vaulting and of the construction of the ceilings of the galleries, everything necessary in regard to the combination of Grecian trabeate and Etruscan arched construction was previously said in Art. 204. These buildings in southern France present many things in regard to joth construction and form, which are not as good and not so beautiful in the mother country of Roman architecture, and on account of their comparatively good preservation, their study is frequently more attractive and instructive, than that of many architectsral works in Italy.

5. The Amphitheatre in Arles indeed likewise dates from the 1 st or 2 nd century A.D., and it was also built with reference to the same points of view concerning form and construction, as well as of the same stone materials as in Nimes. it is to be reckoned among the larger structures of this kind in Gaul, but as always smaller than those in Poitiers (513. × 427. ft.), Perigueux and Lyons. The length of the major and minor axes is given at 448. × 419. ft. in the Table on p. 669, while other sources adopt 460. × 338. ft. between exteriors of walls.[603]

Note 603. The beautiful publication of Ch. Questel in Monuments Historiques (1 st edition without date, Paris), which has unfortunately remained without a text, fixes on 448. × 419. ft., the arena being 228. × 131. ft.

The subdivision of the surface of the facade in two stories is the same as in Nimes, and if elsewhere it is stated that the lower story is divided by half columns, this is incorrect. We find the same rectangular piers as there, as well as the returns about the vertical divisions, a fact, which permits the conclusion, that the same architects were employed in Arles as in Nimes. 60 arches open towards the interior, but these show keystones in contrast to Nimes (Fig. 762, exterior). An inscription still partially legible on the wall of the podium informs us, that a magistrate (duumvir) of Arles, named C. Junius Priscus, spent a considerable sum for improvements, which may well have occurred in the 4 th century. The Amphitheatre was transformed in the middle ages into a fortified place and finished with 4 towers, 3 of which still remain; then it was utilized as a habitation for the poor and later as a stone quarry. The latter use was stopped in 1825 - 30; in 1846 the restoration of the building was commenced under Questel, and it was later continued by Revoil after 1876.

Massive ashlars set without mortar and with the finest jointing, vaults of conical form in the upper story, constructed of slabs set against each other (Fig. 763, interior), the corridors in the lowest story covered by vaults, the well preserved arrangements for removing rain water (M, M in the section, Fig. 764) into the internal and subterranean sewers-- these are many characteristics of the structure, and they afford evidence of a thoughtful execution of every detail. According to the

enlargement conceived by Questel (represented by hatching in Fig. 764, section), the seat steps extended up to the attic corridor, the podium not being reckoned therein, with 3 ranges, so that the construction of an upper gallery with columns appears to be excluded (Fig. 764). The arrangements for the awning were therefore more imperatively necessary; the masts were placed for it indeed in the same manner as at Nimes.

511. Hunts of Animals.

The holding of hunts for animals (venationes) was first introduced in Rome by Fulvius Nobilior (186 B.C.), was eventually transferred from the Circus to the Amphitheatre, and they occurred extensively in the last century of the republic and particularly in the imperial period. To them was sometimes given by costumes and decorations the appearance of a theatrical representation, which had as a subject any frightful mode of death known in mythology or history. They were equipped with scenery in fabulous magnificence, and they continued until in the 6 th century.[604]

Note 604. Compare Marquardt & Mommsen. vol. 8. p.543.

512. Naval Combats.

For the representation of sea fights on a great scale, special basins or naumachias were excavated, the first being by Caesar in the Codeta minor on the Campus Martius in Rome. Two fleets with 2000 rowers and 1000 sea soldiers manoeuvred therein. The second naval combat was given by Augustus in a basin 1800 ft. long and 1200 ft. wide in the country beyond the Tiber. The largest one was carried out under Claudius on Lake Fucino, where 19,000 men fought in the garb of Rhodians and Sicilians.

Concerning the architectural design of such a naumachia, Hülsen[605] gives interesting conclusions, when he parallels the results of the measurements and of the drawings of Revillas and of Canina (Fig. 765). Both give to the ground plan the form of a rectangle, whose end Revillas shapes as a line not entirely straight, he bends it a little near the corners. Canina prefers for it, as for the circus, an unsymmetrical and segmental terminal form (Fig. 765). The ruins of the Vatican Naumachia were discovered in 1743, and it had galleries 13.6 ft. wide and showing masonry of the best kind, in which horizontal courses and die-work (opus spicatum) alternate in height.

The walls themselves were connected together by an oblique tunnel vault, on the top of which were arranged 4 rows of seats. The surfaces of the walls were coated with smooth plaster, composed of pounded tiles and marble dust, which thus protected the masonry from the penetration of water. In the threshold of each doorway leading from the gallery to the arena were found three square openings -- the inlets of a water system, adjoining which were tiles extending down 8.5 ft. and filled with water. But the latter did not appear to be ground water, being rather independent of the water level of the Tiber and in connection with other subterranean systems. From these peculiarities might be deduced with a certain security the conclusion, that we here have to do with the pecular construction and arrangements of a naumachia (Fig. 766). According to Hülsen's calculations about 19,000 spectators could find places on the 4 rows of marble seats over the vault of the corridor with indeed a still greater number on the 9 additional rows of seats behind those and beneath an enclosing portico, which extended to the external wall of the structure.

Note 605. Hülsen in Il Gaianum e la Naumachia Vaticana. Rome. 1902.

Hülsen comes to the following conclusion in regard to the date of construction:-- "To the reign of Trajan may be ascribed with some probability the construction of the Vatican Naumachia." The construction actually occurred in the 5 th century.

Note 606. Hülsen. p. 873.

As we have become acquainted with high buildings in the circus and especially in amphitheatres, so are the peculiarly constructed naumachias to be designated as such of moderate height.

513. Schools of Gladiators.

The gladiators were kept and trained in special schools for the combats. After the time of Domitian, there were in Rome for this purpose 4 imperial schools, with others of the kind in Capua, Praeneste, and in the provinces.

Of their internal arrangement, the ruin XXVII of the ground plan of Pompeii by Overbeck affords a representation, which is now almost generally held to be a school for gladiators: an oblong uncovered place surrounded by porticos, 184 × 147.8 ft. including the porticos 14.45 ft. wide, and further enclosed by the living cells of the gladiators, who were well cared for and safely kept therein.

Chapter 22. Baths. (Thermae).

514. General.

In ancient times, men did not place much importance on baths; Once in each eight days sufficed in the wash house next the kitchen, and in the height of summer, baths in rivers or the sea were taken as needed. Later originated from Grecian models of baths, an arrangement consisting of several bath rooms, such as we find in some Pompeian houses (House of the Labyrinth) and in different villas. After the second Punic war, public baths were erected by communities or speculators (balnea), which were leased to a tenant and were accessible for a bath fee.. Free baths were made possible by endowments or were supported by the treasury of the community.

The bath was a luxurious pleasure in the imperial period, af- there had been introduced the baths imitated from the Grecian palestra, i.e., "extensive and grand designs, which, besides a complex arrangement of baths for different uses, likewise contained the entire equipment of the Grecian gymnasium."[607] The plans and equipment improved from year to year.

Note 607. Compare Marquardt & Mommsen. Vol. 7. p. 268.

The public baths were opened at the eighth hour and in Rome were closed by law before nightfall. In the late imperial period, bathing also occurred during the night with lighting, which appears to have always been the case outside Rome, as in the older baths on Pompeii were found thousands of clay lamps.

The sexes originally bathed separately, later being found the mixed or common baths, not to the advantage of good manners and of the good fame of the female sex.

The monarchs surpassed each other in the founding and erection of these luxurious establishments. Agrippa, Nero, Titus, Domitian, Trajan, Caracalla, Diocletian and Constantine built them. Ruins, often very prominent, of the baths of those rulers and of others have remained everywhere in Italy, in the Danubian provinces, in Numidia, in France, on the Rhine, the Moselle and the Neckar, as well as in England. But no ruin gives in all its parts a clear and complete representation of the entire former arrangement.

515. Arrangement.

The regular baths of the late period comprised:--

1. The stop in warmed air; 2., a warm water bath; 3, a cold water bath; 4, the rubbing. For these at least 3 apartments were necessary:-- The warm room, the hot room, and the cold room, to which might be added with large means a dressing room (apodyterium) and a rubbing room (unctorium), while the sweating room (laconicum) was an arrangement by itself. The arrangement of such a simple private bath is given by Fig. 767, excavated at Caerwent in England. The entrance is through the doorway of the cold room; on the right from the entrance is found the dressing room furnished with hypocausts, on the left is the basin with cold water. to the dressing room succeeds the warm room, also supplied with heating arrangements, and next this is the hot room with warm water basin, and again separated by a doorway is a small sweating room in the direct vicinity of the heating apparatus. The ward air of the heating furnace first strikes the floor of the sweating room, and then the hot room, the warm room, and it finally enters the dressing room pretty well cooled.

516. Tepidarium (Warm Room).

The warm room was usually the first room entered, where men removed their clothing, unless this had previously been done in a special dressing room or in the cold room, and in which men sat down to perspire, to rub and anoint themselves.

517. Caldarium (Hot Room) and Frigidarium (Cold Room).

From thence men entered the hot room and took a bath in warm water, in a bath tub in ancient times, later in a basin, that was surrounded by seats and was arranged at one end of the oblong room (in the proportion of 2 : 3 according to Vitruvius, but elsewhere also built 1 : 2 and 2 : 2.5). At the other end was a semicircular niche supplied with seats, which contained a shallow round basin (labium), intended for cold dashes. Then the cold room was used, one in which was arranged a single or double basin with cold water, in the vicinity of which were placed niches with benches for those waiting. If the water became too cold, the common tank of the palestra could also be used, which lay under the open sky and had the temperature of the air.

The rubbing and anointing sometimes occurred before the warm but usually before the cold bath, directly before replacing the clothing, in order to terminate perspiration; it occur-

occurred in the warm room or in a separate room, as mentioned in Art. 515.

518. Laconicum (Sweating Room).

The sweating room or steam bath came into fashion only at the end of the republic thrJugh Agrippa, and its use was no pleasant freshening but a severe cure, by means of which men desired to avoid the consequences of over enjoyment of the table, and which should primarily assist the digestion. The bath was taken in a vaulted room, according to Vitruvius (Book 5,10), which was furnished with a skylight and means for closing the opening for light (a bronze disk moved by chains), in order to regulate the temperature.

519. Heating.

Everything necessary concerning the heating of rooms has already been said in Art. 272, and it may here be further stated, that the suspensurae (heaters ?) were invented by C. Sergius Orata, an older contemporary of Cicero, and that the small tubes on the walls were of still later date.

520. Other Rooms.

Whatever occurs in addition in the larger baths are arrangements for convenience and luxury, such as waiting rooms, conversation halls, restaurant, shops, or they belong to the equipment of the Grecian gymnasium, such as wardrobes, corridors with columns, promenades (xystos), exedras and the hall for instruction (ephebeum), rooms for oiling and powdering (eleaeothesium and consistorium), room for ball-playing (Sphaeristerium) and the common swimming pool (piscina).

A good general representation of this kind (Fig. 768) of extensive baths is afforded by the Stabian Baths in Pompeii, excavated in the year 1857, which were indeed far surpassed by the great imperial baths in Rome. The plan comprises a men's bath and a women's bath (the former consisting of dressing room, warm, hot and cold rooms; the latter of cold, warm and hot rooms), and further enclosed by porticos on three sides with the basins for those in the palestra and the corresponding dressing and waiting rooms, a number of single baths, a great privy, and on two sides toward the streets were shops and booths. Between the men's and women's baths lies the furnace with the 3 copper boilers for water, as Vitruvius requires.

Besides the Stabian Baths just described, there is a second Baths in Pompeii (Fig. 769 [608]) near the Forum, and a third, (Fig. 770 [608]), which may be designated as "Central Baths." Altogether three city establishments have been enumerated in Pompeii up to the present time, together with two double arrangements, one being for men only, two private establishments and single baths in 12 private houses. The Baths near the Forum are smaller and simpler, but they still enclose the court by porticos on three sides, with the dressing, cold, warm and hot rooms; the palestra and garden are wanting. The Central Baths are distinguished by the most abundant access of light; they have a palaestra with swimming bath and a sweating room.

Note 608. Reproduced from Mau.

As an example of the arrangement of small private baths may be mentioned that found in Villa Rustica in Boscoreale, on account of the good preservation of its hot water equipment.[609] The plan in Fig. 771 shows us the sequence of the rooms, and Figs. 772 and 773 illustrate the apparatus for supplying warm water. Beside the great kitchen with the hearth, the garret stairway and the reservoir for cold water is found the warm room, the hot room with the marble bath tub and the resting place, which were arched over with tubes. At B is the furnace to which 5 steps descend, in it being the leaden boiler at i, consisting of two circular cylinders, 6.56 ft. high and 1.64 ft. diameter, formerly enclosad within a terra cotta covering. The walls of the warm room were covered with knob tiles, then being coated with stucco, and the floor was laid with white mosaic. From the furnace B a heating flue extends beneath the floor to the hot room, above which a semicylindrical boiler (testudo) served to keep the water warm in the tub, as in the Stabian Baths. The well preserved cylindrical boilers are joined with the various pipe circulations as in Figs. 772, 773. The middle pipe serves to conduct the cold water, which may be shut off ba a cock; the lowest one forks just before the boiler; one of the twin pipes leads into the boiler and the other extends through the wall into the tub in the hot room with the corresponding stopcocks. By means of the latter, hot or cold water may be supplied to the tub as required. The uppermost pipe also forks; one branch ends in the boiler; the other goes to the niche for the resting place. Near the bottom of the

boiler is placed the stopcock for emptying it. The desired temperature is obtained by mixture; yet according to Mau,[610] another reservoir for lukewarm water existed in the great bathing establishments. These boilers were so arranged, that the one for hot water stood directly over the fire, that for lukewarm water was above a hollow place, which was connected with the firebox, while the third with cold water was placed directly on the massive masonry.

Note 609. Compare Notizie degli Scavi di Antichita. p. 208. Rome. 1893.

Note 610. Mau. p. 358.

The mixing and heating of the bath water was effected by connecting underneath with the masonry bath tub 15.4 ft. long and 6.45 ft. wide, a detached semicylindrical tubular support, riveted together from bronze plates 0.32 in. thick. The water flowed equally into the bath tub and the hollow support, this latter being continually and equably heated on account of its location directly ower the heating flue, through which the hot air streamed into its hypocaust. The horizontal bottom of the support was 5.9 ins. below that of the tub, thus making possible a constant circulation with a uniformly high temperature of the bath water. The bronze support, the "testudo alvei" of Vitruvius, rested on strong iron cross bars. This heater is certainly a later arrangement, dating from the imperial period, whose use was very extensive, and it is always found where baths were constructed in the Roman domain.[611]

Note 611. Compare Mau, p. 179 and Fig. 87; transuerse and longitudinal sections through the apparatus for keeping the water warm.

521. Imperial Baths.

A great number of interesting drawings and restoration plans of the imperial baths exist, which are chiefly contained in the splendid works mentioned below.[612]

Note 612. Blouet, A. Les thermes de Caracalla. Paris. 1828. -- Paullin, E. Les Thermes de Diocletian. Paris. 1890.

Blouet states[613] that Maecenas was one of the first to build baths in Rome at his own cost; as other builders of such structures are mentioned by him:--

Note 613. Blouet. p. VIII.

Agrippa about	10 A. D.
Nero	64 A. D.
Vespasian	68 A. D.
Titus	75 A. D.
Trajan	110 A. D.
Hadrian	120 A. D.
Commodus	188 A. D.
Caracalla	217 A. D.
Alexander Severus	230 A. D.
Aurelian	272 A. D.
Diocletian	295 A. D.
Constantine	324 A. D.

The number of public baths in Rome increased so much, that about 800 were in use under the reign of Antonine.

Of the two great imperial baths mentioned as published, the plans of the Baths of Antonine and the Baths of Dioclétian in Figs. 774 and 775, and especially the enlarged plan of the former in Fig. 776 -- which is known as the Baths of Caracalla -- afford a representation, of which it must be said, that the uses of all individual rooms of the Baths are not determined. But in general, wer are certain that all great establishments had an enclosed rectangular ground form and contained 3 great principal rooms as the chief parts of the baths:-- the cold hall, the warm hall (cella media) and the hot hall, i.e., the cold bath with the great swimming pool, the lukewarm air bath with arrangements for washing, and the hot air bath with cells for entire baths. All these lie on one axis and form in their sequence one of the grandest architectural views of all times and of the entire world! Of nobly spacious dimensions, with rich subdivision of the walls, with bold and wide ceilings in the form of tunnel, cross and domical vaults, they are unequalled in their detailed and general effect, far less excelled. Even the plain palaestras with their porticos and exedras do not lack grandeur.

522. Frigidarium (Cold Hall).

The cold hall -- for swimming -- in the great imperial baths opened on two sides directly into the adjoining vestibule and into the warm hall on its transverse axis, while the fourth side was entirely closed and was animated only by engaged col-

columns and small niches. The hall was open above (like a hypaethral court), and it was protected against too much sun and wind by the lofty walls. A view of it is given in Fig. 777 614 with a perspective section of the entire design in Fig. 778. 615 The cold room in the latter is assumed to be covered by a low tunnel vault, which is neither in the spirit of the ancients, nor would it have been appropriate for the internal apartment. The assumption of a vaulted ceiling is here excluded by the arrangement of the walls in the plan in both the Baths of Caracalla and of Diocletian; for the long terminal wall would not have been able to resist the thrust of cross or of very low tunnel vaults of a span of more that 65.6 ft. without the arrangement of massive buttresses. Viollet-le-Duc and Paullin are here correct in their assumptions.

Note 614. Reproduced from Viollet-le-Duc. Entretiens sur l'Architecture. Paris. 1863.

Note 615. Reproduced from Hülsen & Rauscher.

523. Tepidarium (Warm Hall).

We have an assured representation of the main hall, the mightiest interior of the design, since for the Baths of Diocletian, this is still preserved, at least in its structural portions. In due course protected from destruction and ruin by transformation into a Christian church (S. Maria degli Angeli), saved by Michelangelo, but reduced in height and spoiled in its ornamentation, yet always having a grand effect in the interior. A conception of how the main hall of the Baths of Caracalla may have originally appeared is given by the restoration of the warm hall (cella media) by Blouet (Fig. 779). The imposts of the cross vaults are strongly stilted, but certainly intentionally and with good judgment. What the architects desired, the unrestricted development in height, Michelangelo injured in his rebuilding of the interior of the Baths of Diocletian into S. Maria degli Angeli by the transformation of the stilting into pedestals. This repeated accenting of the horizontals above the main cornice on the columns may elsewhere be applied to a facade; it is here transferred to the interior in an injudicious manner. (Fig. 780). Auer likewise produces in Fig. 781 a good representation of the interior of the main hall, but he does not entirely attain to what Paulin reproduces

in his brilliant representation of the use of the interior.((Fig. 782 [616]).

Note 616. Reproduced from Paulin, E. Restauration des Monuments Antiques par les Architectes pensionnaires de l'Academie de France a Rome. Les Thermes de Diocletian. Paris. 1890.

524. Caldarium (Hot Hall).

We can obtain an idea of the hot hall and of its former effect from the still standing ruins, that rise above the lunettes in the surface of the dome in the Baths of Caracalla, if we return for a moment to the Pantheon, which has but a few more yards in its clear span. 115 ft. span is compared with 143 ft.

525. Walls and Vaults.

The external walls of this magnificent structure consist of "emplecton", i.e., of concrete masonry faced with triangular bricks, which at intervals of 4.4 ft. in height is bonded together by courses of large flat tiles. The vaults are constructed of tufa stone and are lined internally with tiles 11.8 ins. square. On the exterior of the voussoirs is a coating of mortar 11.8 ins. thick in which are inserted the mosaics, and which forms the floor for the terraces. Sewers and reservoir for water are of masonry in mortar and plastered with cement, the corners being all rounded off.

526. Exterior.

The facades were in part concealed by the adjacent buildings and by clumps of trees. Their surfaces were covered with stucco 2.55 insa thick, but colored glass mosaics have also been found on the facades of the Baths of Caracalla on the side next the xystos.

527. Interior.

Marble slabs must have covered the interior up to the springing of the vaults. The mortar and marble facing were together 3.15 ins. thick, and the columns were mostly of red granite. The upper portion of the walls were covered with stucco and glass mosaics, like the vaults. Besides the red granite already mentioned, there were also employed oriental alabaster, gray granite, porphyry, and giallo antico, with facings of red and green porphyry, serpentine, African red, green, and gray marbles, also pavonazetto, porta santo and white marble.

528. Situation and Surroundings.

The special structures of the baths were detached and were surrounded on all sides by shady walks and gardens, like the Grecian gymnasiums. According to Petersen, [617] here were all kinds of amusements and sports in the open air, thus on the South side was a stadium with rows of seats arranged along the enclosure, in other places were exedras of different forms and dimensions, small booths with porticos near the Baths of Caracalla, as well as separate cells behind the rear wall of the rowsof seats of the stadium. To desire to assign names to all these rooms, which Vitruvius invented, Hülsen rightly objects. [618] He criticises Paulin, in that in his beautiful work on the Baths of Diocletian, he has not entirely freed himself from the terminology of Vitruvius, "who however describes a scheme for entirely different plans, and who could have had no inkling of the baths, since Rome saw them originated in the imperial period." These names were dragged forward from the 16 th century and teach nothing, or merely produce erroneous conceptions.

Note 617. Petersen. Vom alten Rom. p. 97. 1900.

Note 518. In: Drittes Jahresbericht über neue Funde und Forschungen zur Topographie der Stadt Rom. p. 308, 309. Rome 1892.

529. Decoration of the Interior.

How far men proceeded in these splendid interiors in materials and in the artistic furnishing with portable articles for use, sufficient evidence is presented by the Italian museums; particularly that of the Vatican, and in the octagonal court of the Belvedere in this is the wonderfully wrought bath tub of white marble, adorned by relief figures, a partial elevation of which is given in Fig. 783. On Place Farnese stand two antique bath tubs 18.3 ft. long and of polished gray granite, which formerly stood in the side apartments of the warm hall of the Baths of Caracalla, and that now form the most beautiful portion of the fountain on the Place. [619] In the Baths of Caracalla were likewise found famous sculptures, such as the Farnese Bull, Hercules and Flora, that now adorn the Museum in Naples -- evidence of the kind and of the height of the artistic ornamentation of such buildings and of their interiors.

Note 618. In Dritter Jahresbericht über neue Funde und Forschungen zur Topographie der Stadt Rom. p. 308, 309. Rome. 1892.

Note 619. compare Letarouilly, P. Edifices de Rome Moderne. p. 277. Paris. 1860.

530. Imperial Baths at Treves, etc.

As an example of imperial Baths on German soil, indeed of the time of Constantine, and whose 3 principal halls have dimensions not much smaller than those of the imperial baths at Rome, may be taken the remains of the Baths of S. Barbara at Treves (Fig. 784). The cold hall in Treves measures over 164 ft. in length; the same hall in the Baths of Caracalla in Rome is about 180 ft. long! A visit to and a study of the remains of the Roman art offered in Treves and the manner of its presentation may in some cases avoid many a journey beyond the Alps! It may finally be stated, that Hülsen in agreement with Lanciani [620] expresses the opinion, that the Baths of Titus and of Trajan are one and the same. He gives for them a plan on the basis of Destailleur's measurements with the closing remark, "that in general the given plan of the Baths of Titus has a greater similarity to the others, and especially to that of Diocletian, than is apparent from previous sources."

Note 620. Drittes Jahresbericht über Funde und Forschungen zur Topographie der Stadt Rom. p.302, 303. Rome. 1892.

531. Healing Baths.

The discoveries of the French in Algiers have furnished additional material for the baths at springs, which has been worked over by Gsell [621] in an interesting manner. These refer to the Flavian waters (Aquae Flaviana), two warm springs with their buildings, one of which had a temperature of 189.5° Fah. and was enclosed in a vaulted room, while the other poured into a basin through a channel. About 985 ft. from this spring house stood the actual buildings of the Baths. The plan in Fig. 785 [622] shows us the chief entrance at A and B, from which one passed into the vestibule C, then through the doorway E into the great circular hall N, which was vaulted with small tubes and was lighted by a round opening at the crown, thus by a skylight. The similarly circular basin had a diameter of 26.2 ft.; beside it were arranged in the niches in the

walls 4 spaces for tub baths (scholae). Next this domed hall and connected with it by a doorway lay a large uncovered area with a basin 45.3 ft. long and 33.0 ft. wide, with vaulted passages extending along two sides. In the semicircular niche G were found the statues of Esculapius and of Hygeia. Around these two great basins were arranged other smaller rooms and basins, R, K, V, X and _, with some dressing rooms. A dedicatory inscription indicates the year 195 A.D. as the date of the construction by the centurions of the 3 rd legion. We have to indicate here an enclosed room and a basin with the higher temperature of the water, besides which are smaller basins for individual use and then a great open bath with water of lower temperature and with covered porticos, within which those waiting were protected from the sun's rays.

Note 621. Compare Gsell, St. Les Monuments Antiques d'algerie. p. 237 et seq. Paris. 1901.

Note 622. Reproduced from Gsell, St. Les Monuments Antiques d'Algerie. p. 237. Paris. 1901.

Therefore we might indeed assume as likewise uncovered the two larger rooms with basins in Badenweiler and safely regard as certain the bathing therein under the open sky, while the two rooms with smaller basins and also the remaining rooms were covered. The air in Badenweiler is soft and warm, and even today, in addition to the vaulted swimming pool, a great uncovered bath is in use. It would be more correct to agree with the opinion of Wagner, who assumes the 4 bath halls to have been covered by tunnel vaults, which would be possible technically, since the external walls are strong enough for this. The African sky and the air of the Black Forest are different things, and what is permissible under the one is forbidden by the other.[623]

Note 623. Compare Die Kunstdenkmäler des Grossherzogtums Baden. Vol. 5. Kreis Lörrach. Edited by Durm, Wagner & Kraus. 1901. (Ruins of Roman buildings for Baths by E. Wagner. Papers with drawings from 1784 - 1788 in the general archives of the country at Carlsruhe, discovered by Zangemeister in Heidelberg).

Another Bath at a spring, the famous warm Baths of Hammam Meskoutine (Aquae Thibilitanae) exhibits a basin under the

open sky, 171.0 × 30.9 ft. with 3 adjacent halls; the Baths Hammam Berda have a circular basin 115. ft. diameter with spring water at a temperature of 99.5° Fah., -- thus likewise uncovered baths with covered rooms for baths. There is further to be mentioned the Aquae Calidae at Hammam Righa. The dimensions of the basins in Badenweiler are 31.2 × 39.5 ft. for one and 34.1 × 49.3 for the other; therefore the latter warm baths are somewhat larger than those of Aquae Flavianae, but not so large as the others mentioned on African soil.

Note 624. Gsell. p. 239.

On this side of the Alps and in the ruins of the Baths at Badenweiler in the Black Forest is preserved for us an interesting example of baths for men and women, indeed a healing bath with warm springs (now 76.3° Fah.). From the point of view of a healing bath, we should not seek and desire to determine here the warm and cold rooms, etc., in accordance with the usual model of the luxurious baths of the later period; we must rather take into account the different purpose of a healing bath in the explanation of the ground plan, a fact to which too little attantion was devoted by the early investigators.

According to Fig. 786 (plan after Leibnitz and Naeher), the plan is separated by the middle axis into two nearly symmetrical halves, one of which generally must be designated as the men's, and the other as the women's baths. The separate entrances for each division are on the longitudinal axis of the structure and first lead into a forecourt, which could have scarcely been surrounded by porticos, but certainly had a widely projecting roof on the side containing the entrance into the bath halls. Through a spacious vestibule, before the portal of which stood an altar of Diana Abnoba, they passed into two rooms serving for similar purposes, one of which was furnished with a hypocaust and must have served as a dressing room for the sick only, the other being without one and for the reception or comfort of the bathers, perhaps also arranged for the cold and warm seasons of the year, or the location of one on the north may have made the heating arrangement appear desirable, and which had a special furnace. Adjoining these rooms and directly accessible from them as well as from the

vestibule are two rooms on each side, connected by doorways, bath halls of unequal size with great basins and single baths. Before the two middle halls and entered from them lie 5 small rooms, 2 of which are circular with round basins and 3 others are oblong with hypocausts. Before the 3 middle rooms is the furnace. a small room divides the narrow uncovered service court on the south side into two equal parts, but remains accessible from each court.

We believe that we do not err in holding with Leibnitz the opinion, that the hot spring was contained in the small rooms mentioned and the hot water was conducted from thence. The warmest water then ran into the two smaller basins and into the baths of these two halls, which served for the use of the persons actually ill. These could then pass into the naturally hot bath (caldarium) and through special doorways into the sweating cells (laconica) and into the circular cold room for the cold shower or washing. Already cooled considerably, the warm water ran into the great basin, which was chiefly used by those coming for recreation and the healthy persons. The niches in these two large halls might either be for rest or bath tubs. Technically interesting is the mode of covering the margins of the basins and the steps with slabs of dolomite. (See Fig. 767).

Of special type are likewise the Baths of Nimes with their spring, a great peristyle with low columns, niches and swimming pool, a not very plausible representation of which is given by Canina [625], as well as of the sea Baths of Stura [626] drawn by him.

Note 625. Canina. Sez. III. Pl. 144.

Note 626. The same. Plate 143.

Chapter 23. Memorial and Triumphal Arches, Trophies, Memorial Columns, Statues, and Columns of Victory.

a. Memorial and Triumphal Arches.

532. Triumphal Arches.

In honor of the home returning conqueror, there were already erected in the capital at an early date festal ornamented gates or arches, constructed of wood and hung with painted linen fabrics, adorned with garlands, wreaths and trophies, they were placed across and over the street, through which the triumphal procession passed, and they were removed after the end of the festival.

These temporary decorations were changed in the imperial period into permanent structures as monumental evidences, which should preserve for all time the fame of the triumph in the memory of the people.

At first small and without particular expenditure, built with a single passage, they in time assumed larger proportions, received three passages, and were most richly ornamented by sculptures (reliefs and statues) and by inscriptions.

The permanent arches mentioned by Livy (33-27 and 37-33) in the time of the republic cannot be regarded as the "first" stone triumphal arches, according to the clear meaning of the text. The one built by L. Stertinius with war booty at laying down his command in Spain, which expressly occurred without triumphal honors to himself, and the other by P. Scipio Africanus before the beginning of the campaign, were indeed the so-called "Jani", i.e. arches for the ornamentation of the city, adorned by gilded bronze figures and marble basins for water; they were likewise termed "fornices" and not "arcus", such as those of Titus, Septimus Severus and Constantine.

Guadet, Graf, Puchstein and Petersen firmly adhere to the opinion, that those "triumphal arches" were a specifically Roman invention; but nothing of the kind occurs in the numerous representations of triumphs. The name "triumphal arch" (arcus triumphalis) is found but once, and in an author at the end of the 4 th century. The writers of the early imperial period only speak of "fornices" or "arcus". In modern times 4 were first made known in northern Africa designated by inscriptions as "triumphal arches", but which never saw a triumph.

As an assured example of a Tmemorial arch" supporting a statue may be mentioned the "Fornix Fabianus", built in 121 B.C. by Quintus Fabius Maximus Allobrogius; there is otherwise in Rome not a single assured example from the period of the republic of an arch with the honorary statue of one honored by a triumph. But this changed in the imperial period, when to Octavianus Augustus and his family, between 36 B.C. and 14 A.D., are expressly attributed 20 memorial arches, which supported statues. As the earliest example outside Rome and on the market place in Syracuse is to be indicated a Memorial Arch erected for the Praetor Caius Verres in the year 40 B.C., which supported the equestrian statue of the person mentioned with his son, "in heroic nudity."

Note 627. Compare Hülsen, Ch. Zu den Römischen Ehrenbögen. Festschrift Otto Hirschfeld's 60 Geburtstag. p. 423 - 430. Berlin. 1903.

The route taken by these monuments must indeed have led from Greece through Sicily to Rome and thence to Gaul. For the theory of the origin of the triumphal arch in southern Gaul, the evidence has not been produced.[628]

Note 628. Compare Wölfflin. p. 11.

583. Arches remaining.

The imperial arches were even at first not exclusively restricted to the capital; they likewise found their places in the provinces. We know that they followed in Beneventum, Ancona, Rimini, Susa, Aosta, Verona, Pola, S. Remy, Orange, Besancon, Carpentras, Cavaillon, Rheims, Alcantara, Merida, Baia, Caparra, Athens, Thebessa, El Kasr, etc. Among them most frequently occur those dedicated to Augustus, Trajan and Hadrian. Rome alone can still show six triumphal arches, mostly well preserved; the arches of Septimus Severus, of Gallienus, of Drusus, of Titus, and of Constantine, as well as the so-called Gate of the Goldsmiths on the Forum boarium, dedicated to Septimus Severus; of the magnificent Arch of Marcus Aurelius, once ornamented by columns of verde antique, at least the precious reliefs (now in Palace Conservators in Rome) have remained to us. Well preserved are the Arches in Beneventum and Ancona; but all have been robbed of their metallic ornamentation, the gilded bronze statues, equestrian figures and quad-

quadrigas, which are represented on the corresponding medals. The vestiges of fortifications may still be observed on many arches (for example in Ancona).

534. Material.

Most arches are built of resistant and costly materials; thus, for example, at the Arch of Septimus Severus (203 A.D.) the substructure is composed of travertine, the columns of Proconnessian and the other parts of Pentelican marble; the Arch of Titus is likewise constructed of Pentelican, the shafts of the columns of the Arch of Constantine are of Numidian (giallo), the statues of the Dacians are of Phrygian purple-veined Pavonazetto, the heads and hands then being made of white marble.

535. Ground Plan.

The arches mostly appear in ground plan as thin walls or as stage pieces, that have a great archway at the middle, to which were also added two side openings in later times. Fig. 787 gives a comparison of the ground plans of Italian arches and Fig. 788 one of African arches.[629] For the earlier monuments the arch always remains the principal thing, and the architectural accessories are subordinated to it (Rimini, Fig. 789), while for the later, the architectural enclosure predominates (Orange, Fig. 790[630], and Rome). Stairways frequently lie within the walls, which commence at a considerable height from the ground, are accessible from the end of the structure and lead to the platform of the attic.

Note 629. After Gsell.

Note 630. Reproduced from Caristie.

536. Elevation.

The completed type shows in elevation the wall mass penetrated by the arched gateway, and which is subdivided by columns or pilasters with entablature (architrave, frieze and cornice) and ornamented by reliefs. Above this rises a high attic, adorned by statues and the dedicatory inscription, and on it stands the bronze figures; the triumphing general in a chariot or on a horse, surrounded by victories ind trophies. The columns placed before the wall surfaces support a returned cornice composed of the parts mentioned, above which are the piers of the attic or stone statues. On some arches the columns mentioned likewise form the end supports of pediment projections (See Orange, Fig. 790).

537. Kinds of Arches.

Three kinds of designs occur at the same period in the 25 to 30 arches in Italy:-- Arch with one opening and 2 columns; arch with one opening and 4 columns; that with 3 openings and 4 columns. The development in form, as for all the works of any style during the course of its evolution, does not here continue at the same elevation, predecessors that we could already determine in Grecian art, which appear in the Roman and reappear in the works of mediaeval and of Renaissance art.

For the arch, the Augustan architectural period is the preparatory time (the early art), which at the beginning of the 2 nd century experienced a debasing of the forms, and it already exhibits on the Arch of Septimus Severus (203 A.D.) the complete disintegration of high art.[631]

Note 631. Compare Wölfflin, H. Die Antiken Triumphbogen in Italien. Reprint from Reportorium für Kunstwissenschaft. Vol. 16 (1903). Heft 1, 2. Stuttgart. -- Also Rossini, L. Gli Archi trionfali onorarii e funebri sparsi per tutta Italia. Rome. 1836.

As the primary example of the arches in Italy must be designated that actually oldest, erected in honor of Augustus in Aosta in the year 25 B.C.; with otherwise good preservation, only the attic is wanting.[632] Its architecture is still particularly noteworthy; in it is preserved one of the few great examples of a Corinthian colonnade in combination with a Doric entablature, (triglyph-frieze); to the broad and still half Etruscan members of the arch and the likewise yet Etruscan arrangement of the small pilasters on the side surfaces, attention should be paid. (Figs. 432, 791).

Note 632. A good representation of it may be seen in Promis, C. Le Antichita di Aosta. Memoria della Real. Accad. delle Scienze de Torino. Series II. Vol. 21. Turin. 1864.

On this model were arranged the arches in time sequence, in Rimini (27 B.C.; Fig. 789), in Susa (8 A.D.) and in Orange (21 A.D. ?), the Arch Gavier in Verona, demolished in 1805 and only known from drawings, that according to the inscription doubtless belonged to the Augustan period,[633] to the arches of Titus in Rome (82 A.D.), as well as those of Beneventum (114 A.D.) and of Ancona (115 A.D.). All of these exhibit a similar

treatment of the angles of the wall masses, which are particularly characterized by three-quarter columns." This strong enclosure is everywhere a peculiarity of the severe and elevated style," but they do not always require the same form of plan.

Note 633. Compare Wölfflin. p. 5. Note 9.

In Susa the architrave and the corresponding cornice and attic extend straight above the columns (Fig. 792), while in Aosta, Orange, Ancona, on the Arch of Titus in Rome and on the Arch in Beneventum, the two inner columns are connected and are covered by an entablature projecting in the plane of the columns. The angle columns are placed without reference to the inner columns; each supports a returned entablature, whereby the angles are still more firmly enclosed and the middle portion is made far more prominent. On the Arch of Titus in Rome (Fig. 794), on those in Beneventum (Fig. 795) and Ancona, the attic has become a massive part of the structure, but it is always retained within the border of horizontal and vertical lines and produces a quiet ending at top. At the Arches in Orange and Rimini, the pediment occurs over the two inner columns instead of the horizontal termination, which extends into the attic and thus affords a much richer general appearance, especially when as in Orange (Fig. 796), a second attic is placed above the first one. In spite of this repeated subdivision and of the overrich ornamentation of the wall surfaces, this arch cannot avoid the objection of a top-heavy appearance. The beautiful uniformity of the Arch of Titus is not attained by the architect of the Arch in Orange. It is referred to the time of Tiberius, but in my judgement, it falls outside the series of buildings of that period. The panels of the piers with scholl ornaments, the treatment of the archivolt with garlands of fruits and flowers, the semicircular recess in the side tympanums, the console cornice of the first attic, the hexagonal coffers in the tunnel vaults of the archways are things not original on Italian soil. They point towards Spalato, Baalbec and Palmyra, like the overrich ornamentation of the mural surfaces between the columns and cornices, which is no evidence of an elevated style.

The same is true of the Arch of S. Remy in Provence. [634] It

shows the angles enclosed by three-quarter columns, and the leaf and fruit moulding on the archivolts; instead of the impost cap occurs the separate pilaster capital, and the hexagonal coffers are found in the tunnel vaults, just as in Orange and in Baalbec. Senz says of the Monument of Juliers, "it recalls the era of the Pantheon in Rome (but this has recently been referred to the time of Hadrian), but in the details cannot be denied masters with Grecian training." He also believes, that an exact determination of the time cannot be obtained from the architectural forms, but then says that the Arch is later than the Monument, though indeed erected soon after it. This is now carried further by Senz[635] :-- "By the assured use of epigraphic-palaeographic and grammatical criticism, it became possible for Ritschl, more than 20 years since, as well known and with the concurrence of all competent critics, to fix the erection of the Tomb of Juliers in S. Remy during the time of Caesar with full certainty, or at latest in the beginning of the reign of Augustus" -- and Conze adds to the conclusions relating to the sculptures, "that they are a final and freest result of the practice of Grecian art."

Note 634. Compare Senz, A. Der Bogen zu St. Remy. Jahrb. d. Kais. Deutshc Arch. Inst. Vol. 3.(1888); -- also Grabmal der Julier in St. Remy. Antike Denkmäler. Pub. by Kais. Deutsch Arch. Inst. Vol. 1.(1891). Abt. 1887. Plates 13-19. -- Further, Gräfl P. Triumph-- und Ehrenbogen. Reprint from Baumeister's Denkmäler des Klassischen Altertums. Munich & Leipzig. 1888.

635. Senz, A. p. 10.

If the Arches in S. Remy and Orange are to be referred to the Augustan period on the basis of the inscription, we are then in presence of a riddle similar to that of the Pantheon, where the execution, brick stamps and inscription contradict each other. Ornaments and profiles, which are quite rude on the principal cornice of the Monument of Juliers and are out of all proportion to the other members, cannot be brought into accord with the definite arrangements and ornamental motives presented by the Augustan era. I am here of the opinion of Senz, "that the architect cannot follow the time determin-

determination of the epigrapher." On the other hand, I do not conceal from myself, based on an expression of Adler, "that it is conceivable to base the chronological determination exclusively on the decision from the architectural details."[636] The same color and kind of building materials, the same yellow sandstone as in Baalbec, still more recall to me the memory of the allied relations of both works.

Note 636. Compare Romanische Baukunst in Elsass. Zeits. für Bauw. 1878. p. 555.

The arches of the later imperial period distinctly vary in the subdivision of the mass, particularly in reference to the position of the columns. The accenting of the angles by columns was omitted; they were only placed on the front surfaces of the massive structure (compare the Arch of Hadrian in Athens, the arches on African soil (Fig. 788, plan), and the finest of all belonging here, the Arch of Constantine at Rome (Fig. 797)). The columns so placed in this kind are either conceived as the supporters of detached statues and have returned entablatures, or they are grouped in pairs, very effectively flanking the gateway, as shown by the Arch of Caracalla in Thebessa (Fig. 798) and by the Arch of Trajan in Timgad. The pairs of columns on the latter are connected by segmental pediments, which cut into the attic (Fig. 799). The height of the frieze is excessively increased to receive the lengthy inscription, and we find the coupled columns standing on a common pedestal, the entablature with the attic divided by pilasters on the Arch of Septimus Severus at Haidra (Fig. 793). Likewise at the Arch of Severus in Rome it might be believed, that the substructure was merely created to support the tablet for the inscription, which there extends along the entire length of the arch. The end columns reappear above a returned entablature as small pilasters, that form the endings of the inscription tablet, which seems proper, while the two inner columns likewise support a returned entablature and stand before the wall surface without any connection together. Corresponding to the free columns are fluted pilasters with Corinthian capitals on the wall surface, just as on the Arch of Constantine, that indeed also bears a high inscription tablet, whose extent is modified and limited by the

small attic pilasters over the inner columns.

To regard the coupled columns on the principal facade as a criterion for the arches of the succeeding period would indeed be admissible, if the Arch of Sergians in Pola did not stand in the way. The motive is worked out in a peculiar way on it, (Fig. 787; plan), which according to the plan should be placed in the early period, but should be counted with the works of the later time by its elevation. "Instead of the projection of the entablature above the gateway proper and being returned at the sides, it remains flat on the wall at the centre in order that, projecting at both sides, the pair of columns are connected together." We have to do here with a corner return above coupled columns, for whimh another example cannot be named.

The Arch of Sergians mentioned is referred to the time of Trajan, by what right? The inscription affords no information.

In Pola stand two monuments, which may be considered in answering this question:-- 1. the Temple of Augustus, and 2. the Temple of Diana.[637] The former is unouestionably to be referred to the Augustan period, indeed justly so according to the beautiful scrolls in the frieze, the Corinthian capitals, and the finely treated modillion cornice on the sides and the ends, as well as on the pediment. Modillions and dentils are absolutely vertical on the pediment cornice, but the corresponding beaded astragal is perpendicular to the low inclination -- just as on the TMaison Carree" at Nimes. These details are all finely designed and beautiful; but they contrast singularly with the architrave in three bands, the inclined faces and the plain crowning moulding.

Note 637. Compare Stuart, J. & N. Revett. Antiquities of Athens. Vol. 2. Chap. 2. Temple of Rome and Augustus, Temple of Diana at Pola -- and Chap. 3.(p. 631), Arch of Sergians at Pola.

On the Temple of Diana, the details of the cornice are less refined , and still less so though yet animated are the scrolls in the frieze. The architrave is just as rude as that of the Temple of Augustus. This likewise occurs at the Porta Aurea (Arch of Sergians), whose proportions are exceptionally beautiful, its details and remaining sculptures must be designated

as fine and good, so that properly no ground exists for dating it later, especially if we also throw the position of the columns into the scales. The modillions also have the same scrolling, though a front one, on the monuments mentioned. The sequence of the cornice members on the Arch of Sergians leaves something to be desired; over the dentils is lacking the echinus moulding, and the different members are less beautifully shaped. The scroll ornament on the archway jamb (vine and acanthus leaves) and on the surfaces of the impost piers, as well as the free treatment of the coffered surfaces of the vaults on the contrary again recall Orange, S. Remy and Palmyra. The new measurements recently undertaken by the Imperial Austrian Archaeological Institute will perhaps throw more light on the matter.

A form varying from those heretofore given is shown by the Arch in Macteur (Fig. 798). The archway is like a shrine flanked by half columns, covered by a triply divided architrave and adorned by a pediment. This arched architecture serves as a foil to a wall ornamented by columns, which is merely crowned by a modillion cornice and ends in the form of an attic. Only the Arches in Sukera and Abdelmelek exhibit the same beautiful arrangement. The value of the free figure ornamentation, that stood on the attic of the arch, can no longer be determined; the costly metal first fell as a sacrifice to the avarice of men. But if we can draw any conclusions from the figure reliefs of the Arch of Titus (Fig. 800), then must this likewise have been of the elevated style. What is in this respect to be prized on the Ara Pacis exists likewise on the Arch of Titus.

538. Janus Arch.

For the form and not their importance are to be included here the Januses, the arches, that were either of a sacred nature, adorned with statues of the gods and erected to beautify the city, or those for occasional shelter, that found place at the intersection of streets or on public squares. An example of such an arch with four fronts is still preserved in the Arch of Janus Quadrifrons in Rome, now deprived of its statues. The Arch of Caracalla in Thebessa must indeed be regarded as another (Fig. 788; plan).

b. Tropbies.

"The simple monument of the arms of a beaten enemy was transformed into a military ornamental object, whose form alone determined its decorative effect."

539. Trophies.

From Greece to Rome was transferred the custom of erecting a memorial of victory on the battle field in order to preserve its remembrance at the time and later, and at the same time as a warning example for the enemy. Since Thucidides and Xenophon, the trophy remains the typical close and indispensable token of every victory, which chiefly consisted of the armor of Roman soldiers of the Augustan period (Fig. 801, enlarged from a coin); the arms must form the monument!

540. Various Trophies.

In combination with architecture at about the end of the the republic and in the earliest imperial period, the trophy received its highest monumental expression. As the most beautiful example of such a memorial of victory may be taken the finely composed so-called "Trophy of Marius", previously mentioned in Chapter 14, and which Sixtus V had transferred from the niches of a fountain of Aqua Julia to the balustrade of the Place of the Capitol, and which may date from the earliest imperial period.(Fig. 802).

Famous likewise was the Trophy of Pompeius, erected at the top of a pass in the eastern end of the Pyrenees, which gave offence by its magnificence. As a contrast to this can be considered the Augustan Trophy at the apex of a pass in the Maritime Alps not far from Nice and above Monaco, which was erected in 7 to 6 B. C. It consisted of a square substructure with sides of 130 ft., on which and set back about 10 ft. on each side rose a square pedestal, that supported a circular tower 100 ft. in circumference, which was surrounded by two stories of columns above each other. The termination was formed by the trophy of arms represented in Fig. 801, together with seated and fettered figures.[638]

Note 638. An interesting study of this Trophy with illustrations was published by Otto Benndorf under the title of "Le Trophee d'Auguste pres de Monaco (La Turbie). Paris. 1904. -- Niemann attempted a restoration in this, which is reproduced

in Fig. 803.[639] It is based on an allied Ephesian Monument of the Hellenic period (Fig. 804), -- a circular structure ornamented by columns, that may have supported a conical roof with a trophy of arms.(Compare Reprint from the Jahresheften des Oest. Arch. Inst. Vol. 6. p. 265. Vienna. 1903).

Note 639. Reproduced from Benndorf, O. Le Trophie d'Auguste pres de Monaco (La Turbie). p. 19. Paris. 1904.-- For a view of its present state, see p. 17 of the same.

An immense and also peculiar and beautiful work was the Trophy of Trajan at Adamklissi (Fig. 805). Constructed of concrete (small broken stones with excellent and strong lime mortar) and faced with limestone ashlars, it exhibits above a stepped structure 7.9 ft. high a cylindrical wall 98.5 ft. in diameter and 24.7 ft. high, a total height to the base of the trophy, that was formerly about 87.8 ft. The ashlar facing was furnished with hook-shaped metal cramps 11.8 ins. long and 1.57 ins . wide, and the frieze blocks were connected together by wooden or stone dovetail cramps 14.2 ins. long.[640]

Note 640. Compare Das Monument von Adamklissi. Tropaeum Trajani. Published by G. Tocilesco with the collaboration of O. Benndorf and G. Niemann. Vienna. 1895.

In the imperial period, the so-called Wall of Trajan protected the northern border of the Roman empire, and in"evident connection with this military work, there stands at the south of it the Roman Monument of Victory, the mightiest work of antiquity on Roumanian soil; indeed deprived of ornaments, yet the form of its nucleus still affords an impression of the whole, now ruined by earthquakes and the hands of barbarians. The externally squareed circular structure was once decorated by a frieze of panels decorated by figures, which were separated by small pilasters -- comparable to a triglyph-frieze, that was protected by a cornice, above which a row of battlements terminated the vertical portion of the masonry. But not repeating in a senseless manner battlements of walls arranged for defense do these occur; merely their form is emphasized, whereby the high battlements were adorned by the statues of captured barbarians in relief, and the parapet with the forms of shields. Behind the battlements is arranged a walk A ornamented by openings for water (Fig. 806), from which rises the low

conical roof covered with stone slabs abutting against the masonry rings B and C. Grandly are here transformed in a masterly manner the architectural forms, no longer entirely intelligible, -- the triglyphs become small pilasters and the recessed metopes are panels with reliefs --, a token that even the petrified has awakened to new life, when a savior appears. Above the scale-like roof rises a polygonal base and on the latter is a structure ornamented by angle pilasters and blind arches (Fig. 805), on which was erected the trophy proper, the arms of Roman soldiers with fettered captives, visible afar. The general view shows the pedestal kept low in accordance with the materials there. But since other portions of the monument were found later, there resulted a different form of the superstructure, which is drawn in Fig. 807. It is due to Fürstwangler, who in collaboration with the architect Bühlmann finally determined the correct elevation of the monument, which the authors of the first excellent publication relating to the building (Benndorf and Niemann) accept without reserve.[641] The inscription, as well as the detail forms of the architecture and of the sculptures indicate the period of Trajan and are not to be referred to the time of Augustus, as asserted by Fürtwangler. The sculptures are the work of soldiers and are not artistic, like those which the Augustan period produced elsewhere, but the grandeur of the design is not injured thereby.[642]

Note 641. Compare Fürtwangler, A. Das Tropaion von Adamklissi und provinzialrömische Kunst. Munich. 1903. From the Abhand. d. König. Bayr. Akad. d. Wiss. Cl. I. Vol. 22. Abt.3.

Note 642. Attention should also be called to an error in the otherwise magnificent publication of Tocilesco -- not in criticism but for truth. On p. 19 of the essay mentioned in Note 640 is stated, "that not merely the pilaster capitals, but likewise their bases have projections at the sides and not in front," which contradicts the drawing in Fig. 12 on p. 8. The capitals certainly project, but not the bases.

541. Ara Pacis Augustae (Shrine of Peace of Augustus).

Not for the glorification of splendid deeds in arms is a monument, which remains to be mentioned in this place:-- the Ara Pacis Augustae in Rome, a magnificent memorial of Augustan art, that should represent to the eye "the blessings of the new

monarchy and its era of peace." Built in the year 9 B.C., a portion of the structure yet remains beneath the early Palace Fiano in Rome; fragments of it are found in the Museums at Rome, Florence and Paris.

No colossal structure holds the eye captive; but we behold instead a splendidly decorative show piece of Augustan architecture and sculpture of the finest and most spirited kind, executed in Carrara marble. A rectangular area of 38.0 × 34.5 ft. is enclosed by a wall with two entrance openings, whose interior is dignified and simple, but its external surfaces are happily and splendidly covered by scholl ornaments in relief and figures, and it was once animated by color. We can conceive an idea of this architectural work from a representation on a coin of Domitian to be found in Paris.[643] According to this, the wall rises above a plinth substructure; a narrow flight of external steps leads to the height of the base and to the uncovered interior; pilasters at the angles and the doorways subdivided the walls into enclosed panels; a band divides the height of the wall in two halves, that are adorned by sculptures. An entablature in three divisions crowns the wall; the angles have attached the forms of uncertain acroterias. The ratio of the width or length of the structure to its height in the figure on the coin does not correspond to the actual finds; yet this ensures the base, the steps, the doorways, the pilasters and the sculptures on the wall surfaces. But we receive from the discoveries a representation of the internal surfaces of the walls. Panels are chiseled in the stone, bordered by a band at top, over which are gracefully wrought festoons with rosettes. The scroll ornaments and the sculptures on the exterior, as well as the profile of the base and the band covered by a fret, the pilasters, the panels and their capitals, the profile of the architraves of the doorways are likewise assured by a considerable number of pieces found, as well as the locations thereof. There are only lacking at this time all data for the angle acroterias and the crowning cornice, but whose height is not hard to fix from the pilasters, and whose detail forms can indeed be approximately determined. And the coin of Domitian affords some reliance, for with the representation in Fig. 809, we cannot va-

vary far from our aim. The wonderful scroll work shows leaves and flowers, on which hover the swans of Apollo with outstretched wings. The figures represent a festal procession of distinguished Romans with women and children, as well as the earth with the winds, the description of which in detail would extend too far here.

Note 641. Compare Petersen. p. 5. Pariser Münze.

Note 644. Compare the following papers:--

Petersen, E. Ara Pacis Augustae. With drawings by G. Niemann. Sonderschriften d. Oest. Arch. Inst. in Wien. Vol. 2. (1902).

Petersen, E. L'Ara Pacis Augustae. Mitt. d. Kais. Deutsch Arch. Inst. Röm. Abt. Vol. 9.(1894). p. 171 to 228.

Domaszewski, A von. Die Familie des Augustus auf der Ara Pacis. Heidelberg. 1903. -- Reprint from the Jahrb. des Oest. Arch. Inst. in Wien. Vol. 6. (1903).

Petersen, E. Berühmte Kunststätten. No. 1. Vom alten Rom. Leipzig. 1900.

Pasqui, A. Scavi dell' Ara Pacis Augustae. Extract from Notizie degli Scavi anno 1903. Fasc. 11. Rome. 1904. With very instructive section based on new finds.

Lanciani, R. Ruins and Excavations of Ancient Rome. p. 466. Ara Pacis Augustae -- one of the most artistic productions of the golden age. Boston & New York. 1897.

Duhn, von. Ara Pacis- Monumenti dell' Istituto. Vol. 11. p. 36.

Schneider, A von. Das alte Rom. Development of its plan and history of its buildings. Pl. 7. Leipzig. 1896.

c. Memorial Columns, Statues, Columns of Victory.

542. Memorial Columns.

Another ornamental monument was the Memorial Column commemorating the person of the commander and of the emperor, a favorite in the imperial period. Originally a pedestal for a statue after Grecian precedents, it later also became the bearer of the sculptured representation of the deeds of the person honored, which it exhibited as sculptured in relief on its external surface. The monument was composed of a square pedestal of moderate height, of the colossal column itself, and of the cylindrical top with a cap, that received the statue.

It was awarded to the deserving person, at first by the senate, later by the people, and the cost was provided from state resources and from collections.

543. Columns remaining.

To the earliest memorial columns in Rome belongs the Columna Rostrata, which was erected in honor of Duilius and in memory of his naval victory, was adorned by the prows of ships (26 B.C.). A suggestion of its form is now only afforded by the pedestals occurring on the silver coins of Augustus and Vespasian, with their columns supporting the imperial statues and ornamented with the beaks of ships. The exact representation of a beak is given by Fig. 812 after a marble fragment found in the Museum at Aquileia. The doubtful entire form in 813 is drawn after a fragment exhibited in the Muesum Capitoline. at Rome.

Of the memorial columns of later date, well preserved examples still remain standing in Rome, Cussi, Alexandria, Ancyra, Constantinoble and Brindisi, of which those dedicated to Trajan and Marcus Aurelius in Rome (Figs. 814, 815) are the finest and most magnificent. Each is composed of 28 cylindrical blocks of marble, and they rise on square pedestals 88.6 and 97.0 ft. high into the air, respectively exhibiting 22 and 20 spiral turns, with relief representations 658 ft. long as scenes from the wars of Trajan against the Dacians and from those of Marcus Aurelius with the Marcommanns. Winding stairs with respectively 185 and 206 steps lead in the interior to the platform of the abacus of the capital, from which rises the cylindrical top with a cap, that bore the gilded bronze statue of the emperor.

The otherwise usual fluting of the column is recalled only by a narrow band beneath the round of the capital.

544. Pedestals for Statues.

The pedestals of the Columns of Trajan and of Antonine (Fig. 815) afford desibable data for the manner in which the pedestals for separate statues were treated; a less pretentious pedestal, that supported the statue of Agrippa,has been preserved for us at the ascent to the Propyleum in Athens. But the cylindrical form, the column, and the triangular shape (pedestal of the Nike (Victory) of Paeonios, and various bases of

candelabra) were likewise in use, after Grecian models.

The sculptures in stone or metal and elevated on a pedestal generally exhibit a quiet and restrained pose (Statue of Tiberius (Paris), Bronze Statue of one Camillus (Palace Vatican, Rome), and many others; but the equestrian statues show the same treatment. Not wild and prancing horses with venturesome attitudes of the rider attempt to spring from the pedestal to the pavement; yet the rider seeks to restrain his horse from such a purpose. There always predominates monumental repose in the man and the animal. Best expressed indeed is this conception for the bronze and gilded equestrian statue of Marcus Aurelius; but even in representations the less important personages (see the equestrian Statue of Balbo in Fig. 816) it was firmly retained; rider and horse are without any pompous adornment; bridle on the horse, sometimes also a fringed saddle cloth also, the seated rider without a belt, but with a tunic and the toga falling quietly. Even the emperor Marcus Aurelius was satisfied with this simple equipment for his equestrian statue. The horse usually walks slowly and sometimes produces an impression, as if he draw a heavy wagon behind -- a difficulty not always intended. The saddle horse easily becomes a draft animal!

545. Columns of Victory.

The last kind of triumphal monument is formed by the Gallic=Rhenish columns of victory, of which Fig. 817 affords an illustration. About 50 such columns have become known. The name of Jupiter or giant's columns has likewise been applied to them. Generally made of the stone quarried near the site, they were carried to a height of 39.5 to 46.0 ft. Those with assured dates are referred to the period of 200 - 400 A.D. Where inscriptions exist, we meet with the dedicatory formula to Jupiter Optimus Maximus. (I.O.M.). The ornamental and figure sculpture is always of bad workmanship, although to the grapes and figs on the columns, life and movement cannot be denied. These monuments consist of a plinth with representations of the gods of the week, that stands on a square pedestal, and of a column, which supported the equestrian statue and the giants. Others insert a round or polygonal base beneath the smoothly wrought or scaly shaft of the column with the capital like the Corinthian.

In contrast with the conception of the ornamentation on personal monuments, the rider is galloping on a leaping horse, supported by a snaky being or carelessly passing over a prostrate youth. The idea that the rider is Wodan and that the snaky man is a servant giant, that it represents Jupiter or one of the gods of the Celts, is to be rejected, according to Maass.[645] This learned man sees in the column of victory a gift to the god of empire (Jupiter) in honor of the imperial house.

Note 645. Compare Maass, E. Tie Tagesgötter in Rom und den Provinzen. III. Die Tagesgötter an den Gallisch-Rheinischen Siegessaulen. p. 171 et seq. Berlin. 1903.

The columns were to make known the fame of Rome, and their places at the intersections of streets, open squares, on the tops of hills, and at the crossings of rivers were very appropriate. The triumphant rider was no god; he much rather expressed the emperor or the general, and the giant is nothing more than a subjugated and conquered enemy! On the other hand, Hettner, in his illustrated Guide through the Provincial Museum in Treves[646], firmly adheres to the assumption, that the rider doubtless represents Taranis, the Gallic god of thunder. "Supported by giants, the god rushes through the heavens." He refers the dated monuments to the period of 170 - 246 A.D., while Maass permits them to extend into the 5 th century, thus about in the time of Honorius.(395). Hettner emphasizes the similarity of all these columns to the "Heddernheimer" and allows this type to have originated in Gaul. It is wanting in lower Germany, on the Danube and in Italy. Like Maass, he describes the monument as consisting of a pedestal, that is ornamented by reliefs with 3 or 4 gods. Then follows an intermediate plinth, on which are represented the seven "gods of the week"(should these indeed be termed gods of the days?), above which rises the column with its capital and the equestrian group. On the capital and between its volutes are placed the heads of the four periods of the day or of the seasons of the year.[647]

Note 646. Hettner. p. 51, 52. Treves. 1903.

Note 647. In conclusion, Hettner refers to the same thing in Westdeutsche Zeitschrift für Geschichte und Kunst. I. p.47; ~~a~~- also Bonner Jahrbücher 95. p. 261.

Chapter 24. Tombs and Sepulchral Monuments.

546. Care of the Dead.

The tomb was also among the Romans a dwelling, "according to the harmonious views of antiquity, into which the deceased withdrew in order to commence another and better existence, yet one corresponding to his former life. Therefore it has the character of a house (symbolically or actually), which requires a definite arrangement, both for the dead and likewise for the gathering of the family near the dead." Hence clothing, food, money, arms, tools etc. were required and were deposited with the deceased, toilet articles with women and toys with children.[648]

Note 648. Compare Marquardt & Mommsen. Vol. 7. p. 355.

The house is symbolically embodied in both the boxes for ashes of Albano, that imitated the ancient shepherds' huts, the capanna, as well as in the slanting roof tiles of the soldier's grave, as if affording shelter. We see it nearly approaching reality in the great sepulchral chambers hewn in the rock, with the different rooms and in the tombs of the great and of princes extending to several stories, and we found it earlier in the tombs of the Etruscans and in the rock-cut tombs of Asia Minor, imitated from the cabins of wood or of wood and stone.

547. Preparation for Burial.

The form and size of the new dwelling partily depended upon the mode of disposal of the dead -- here by burial or by cremation. Burial was the most ancient custom in Rome and Latium; besides this occurred cremation, just as in Etruria, and sometimes the one or the other predominated.

In the 1 st century of our era, sarcophaguses were a rarity in Rome; they more commonly occur in the period of the Antonines and regularly in the 3 rd and 4 th centuries, when Christianity again put an end to cremation. Yet the latter was never entirely dropped; Charlemagne, on the contrary, even ordered that it should be permitted.

For cremation served a special open space separated from the burial place, the ustrinum. The wealthy owned a piece of ground for this purpose in the vicinity of their tombs; the poor took their dead to the public place of cremation.

548. Mode of Burial.

In Rome itself, the most ancient mode of burial is found in sepulchral chambers 12.5 ft. long and 6.34 ft. wide, cut in the tufa and always intended for 4 bodies, which were placed with their feet towards the entrance doorway; also stone boxes for ashes cut in a single piece, 1.97 × 1.31 × 1.81 ft., or sarcophaguses of several pieces and furnished with flat lids and containing vessels of clay and bronze; also sepulchral chambers 16.4 × 13.1 ft. built of ashlars, which belong to the period of Sulla. Here are also to be enumerated the deep pit graves (puticuli), common burial places for poor persons and slaves, who were not burned but heaped together and left to decay. Executed criminals were left on the ground as prey for carnivorous animals.

Poor persons were interred in Pompeii in the Pomoerium at the base of the city walls, the name of the deceased being scratched on the stones of the city wall, or the place was marked by placing a tombstone in the form of a hermes.[649]

Note 649. Compare Overbeck. p. 396.

The distinguished personages, thus for each Roman gens or clan, had a common burial place, where the relatives of the same name, their freedmen and also their clients and friends found their place of repose. These family sepulchres extended to the imperial period.

549. Burial Place.

In the most ancient period, the Romans must have buried their dead in the house and within the city. But the law of the twelve tables already contained the decree:-- "Neither bury nor burn a dead man within the city," which always remained in force. This was only suspended for the vestals and for certain persons "because of virtue." Thus the Valerii and Fabricii had a burial place on the Forum; such were assigned by a law in rare cases, on the Campus Martius.[650]

Note 650. Compare Marquardt & Mommsen. Vol. 7. p. 350.

Outside the city -- even if not at a country seat -- the cemeteries began directly before the gates and all the great roads proceeding from Rome were bordered by tombs, which by their inscriptions preserved the memory of the dead; on Via Praenestina, Tiburtina, Labicana, Appia, Latina, Ostiensis, Laurentina and Aurelia, they rose together in part with mon-

monuments for a permanently honored remembrance, which frequently caused the tombs of the wealthy to be works of the greatest magnificence, and those of the emperors became colossal architectural structures of the first rank.

550. Streets of Tombs.

These streets of tombs vary in their architectural forms and purposes. We distinguish between subterranean tomb chambers of the Etruscan type and isolated structures of different forms and dimensions.

As the former may appear the Tombs of the Scipios not far from Gate S. Sebastiano and the Tomb of Nason on Via Flaminia near Rome; their proper domain remains in Arabia Petra and in Palestine. It is with the detached structres that we are to first deal, since in them is embodied a good part of Roman architecture and sculpture. It will not be forgotten here, that by patrons and artists were made serviceable the forms of the tombs of all nations, with which the Roman people came into contact in war or in peace. The native sepulchral type of an aboriginal and later subjugated population contributed something of importance to all these creations, and certain works become intelligible and excusable only from this point of view. The imitation of the tumulus of Asia Minor and Etruria, of the Egyptian pyramid, such of the temples and of central buildings, of Syrian sepulchral towers, of sarcophaguses, altars, exedras, triumphal arches and circular benches (scholae) were common. Besides much that is beautiful is likewise produced much that is bad, like the Tomb of the Baker in Rome, the sepulchral Triclinium in Pompeii, and the great Tomb in Treves with representations of sports in the circus and with ships loaded with wine casks and equipped with towers, etc.

However well the Romans elsewhere understood how to give a national stamp to their works, for the tombs, the will of the individual and fashion were stronger. To classify them can be done only with reference to the part of the country in which they stand, to a limited site and their special nature. (For example, compare Etruria and Arabia in contrast to the flat seacoasts of Adria). For evidence of this, the sepulchral monuments of different regions will be more thoroughly considered.

551. Tombs at Pompeii.

a. The graves remaining in Pompeii belong to the imperial period with few exceptions; they were arranged before the Gate Nola and along the city wall for poor people; for the wealthy, they extend along the streets of tombs to more than 1 1/4 miles from the city gates. The few preroman graves have unburned corpses, all others had urns for ashes, partly interred in the earth and partly deposited in stately monuments. The latter were built in the form of an altar, a temple, atriumphal arch, of a niche or of an uncovered semicircular seat. Others were reduced to simple memorial stones, the so-called headstones.(compare the two examples in Fig. 818). These imitated the outline of the form of the human head and sometimes exhibited on the back false hair, differing for men and women, while the front side was smooth and inscribed. From the size of the stones it might be determined, whether they were intended for adults or children.

552. Tombs at Aquileia.

b. The Museum in Aquileia offers a very instructive collection of tombstones, by which a greded series of the Roman sepulchral monuments may perhaps be best gone over. Enrico Majonica [651] prefers to subdivide them as follows:--

Note 651. Der Verhandlungen der 42 Versammlung deautscher Philologen und Schulmänner in Wien. p. 339. Leipzig. 1894.

"1. Those that only indicate the burial place by external marks (no inscriptions). (Cenotaphium, Commencementum, Cubiculum, Domus, Reboum, Hypogaeum, Mausoleum, Sepulchrum, Tumulus).

2. Sepulchral monuments that served to preserve the ashes or the bones.(Arca, Cinerarium, Hydria, Olla, Ossuarium, etc.).

3. Inscribed stones for indicating the limits of the area of the tomb. (Cippi, Columnae, Hermae).

4. Those having the form of a small temple (Sacellum, Aedicula) or of an altar (Ara).

5. Inscribed stones, which were merely portions of a larger monument."

The urns for ashes, the second of the given categories, have different forms; that of the ancient house, of the small temple, the altar, the sarcophagus, the bed for repose, etc.

The appellation "cippus" is only applied to the second category; cippuses are merely to be understood as being the four

four corner pillars of the burial area.

The fourth class, that of the small temples and altars, comprises the monuments, whose shape was influenced by a religious representation. This is only to be explained as worship of the dead, by the service of the gods of the shades, to which, just as to actual deities, temples and altars might be consecrated. But as soon as the religious conceptions of many forms had obtained influence over the shape of the memorial, it became necessary to also determine and classify the external tokens of the emanation of the definite religious representation. Thus in the region of Aquileia it may be clearly followed, how the worship of the Magna Mater and of Attis, also of Silvanus and the water deities, influenced the form of the sepulchral shrine. The exhibition of the provincial type of the small temple and altar at the same time closed the history of the spread of a certain worship.

In the fifth class belongs the great number of fragments of monuments with complete inscriptions. Thus for example, a rectangular base with inscription on the front must be added to the altar, part of which it formed. "It is otherwise stated that tombstones, whose fronts have a little temple in relief, are to be regarded as temples.

Fig. 819, a to g, presents a series of types of gravestones from the Museum mentioned, from the simplest form of the rectangular slab for a wall, of the period of the republic to the urn for bones in altar form (ossuarium) and the little temple in relief. The wall tablet is succeeded by the detached rectangular slab, then the slab rounded at top. Some of these were connected by square timbers and fixed in the ground (m and n in Fig. 819 c); others by round timbers lying in the earth. (h in Fig. 819 c). There succeeds the rectangular slab d enclosed by stopped cove mouldings, then that having a triangular termination, and finally that adorned by flat pilasters and a pediment. Fig. 819 g exhibits the altar form with single and double cavities to receive the ashes. Fig. 824 gives the complete altar form of which marble with the beautiful relief of a genius. Figs. 821 and 822 show corner piers (cippi) of larger monuments, which are covered by recurved ornamental caps. As peculiarities should be mentioned the urns for ashes

preserved in numerous examples, chiseled from gray limestone, which are similar to woven baskets and show a dog or lion stretched out on the cover (Fig. 823). The caps of the small corner piers are adorned by a pineapple or artichoke; for a larger monument -- a so-called triclinium -- there occurs in this place a Corinthian capital crowning the top (Fig. 820), which again supports a pineapple as the final termination. Besides these simple specimens are preserved the remains of larger monuments, evidence for which is supplied by a large marble lion, capitals, friezes, architraves, corner posts, plinths, etc.

One custom is peculiar to the tombs of Aquileia, i.e., the statement of the dimensions of the tomb cut in the stone, both in depth and on the street front, for example on the slab in Fig. 819 d, e, completely given, and partially for the false temple on the plinth. Sixteen ft. in width and depth appears to be the normal measure for the burial lot, but it might on occasion be increased in depth to twice as much, and it likewise experienced other extensions in both directions.

L.Q.P.XVI = locus quadratus. pedes 16 = lot 16 ft. square.
L.M.IN.FR.P.XVI = in fronte, pedes 16 = 16 ft. in front.
IN.AGR.P.18 = in agrum, pedes 18 = 18 ft. in depth.

Other insppictions are:--

IN.FR.P.XVII = 17 ft. front.
IN.AG.P.XXXII = 32 ft. depth.

L.M.IN.FR.P.XVI = 16 ft. front.
IN.AGR.P.XXXII = 32 ft. depth.

LMQ.Q.P = 16 ft. square. Q.XVI

Other dimensions occurring are:--
16 × 26; 16 × 32; 16 × 25; 16 × 24; 20 × 31; 20 × 40.

553. Tombs in Arabia Petra.

c. In Arabia Petra, the tombs are at first an imitation of the house in which the living citizen of Petra dwelt,; this was erected with inclined external walls, covered by a flat roof and crowned by a row of battlements.[652] Fig. 825,I to VIII give the phases of development of them as established by von Domaszewski. He designates as the earliest type of pylon tombs with single, then with doubled battlements (I and II); then he passes over to the stepped tomb (III), on which occurs

the Egyptian cavetto as the crowning cornice. Under Grecian influence was the proto-Hegr and the perfected Hegr tomb (IV and VI) with its Corinthian pilasters, the triply divided entablature and the attic, which ends in a row of battlements with an Egyptian cavetto beneath them. The entrance doorway is likewise flanked by pilasters and bears above the entablature the low Grecian pediment with acroterias. Then follows under Roman influence the arched tomb (V), then the so-called garden tomb, the Roman temple tomb (VII), and lastly the obelisk tomb (VIII) with its blunt and low pyramid, which is at the same time a tomb in stories. Interesting is the effect of the Roman temple tomb (IX in Fig. 826), recalling in its lower parts the type Hegr, but then passing into a different form of ending. Above the entablature is placed a series of small pilasters with projecting volute capitals like Corinthian, over which is a Doric triglyph frieze with low pediment and acroterias recalling Etruscan works. With this may be mentioned the General's Tomb of Sextius Florentinus.[653] We here have to do with non-structural architectural works; all are cut from the nearly vertical rocky wall, great decorative works, which in this respect are rather to be termed the works of sculpture, behind which are found plain excavations as sepulchral chambers or places of assemblage. Bore holes into the wall of rock determined how deep these should be wrought. To a height of 85.5 ft. rise these grand ornamental works of Roman barocco architecture with their broken pediments and capricious subdivisions and grouping in elevation, which only desires a picturesque effect as its aim, throwing aside the elevated dignity of architecture. (Fig. 827).

Note 652. Compare Domaszewski, A. von & R. Brünnow. Die Provincia Arabia. Vol. 1. Strasburg. 1904.

Note 653. See Domaszewski, A. von & R. Brünnow. No. 763.

Only one tomb, or rather a rock-cut temple in Petra forms an exception thereto -- the fabulous Hazne (Figs. 828, 829; view and horizontal section), "the sole representative of Egyptian-Hellenic temple architecture,' as von Domaszewski terms it, and the greatest puzzle of this city. It remained without effect upon the facades of the tombs of Petra, and Domaszewski therefore refers it to the latest period of Roman rule under the reign of Hadrian (131 A.D.). Socin pref-

prefers for most of the buildings the 3 rd and 4 th centuries of the Christian era. But one need not go so far for the explanation of the barocco forms; Pompeii can already supply them and Aquileia likewise exhibits such in the ogee conical roofs with their Corinthian capitals and pineapples on tombs, that belong to the period of Nero. The architecture of the lower story of the Hazne is almost of Grecian chasteness, as well as the forms of the upper story, even if the subdivisions there must be termed capricious. The whole is interesting like a creation of the time of Louis XVI. It is a shame that the sculptures should have been destroyed by the bands of barbarians, but it is also a good fortune, that a succeeding new civilization did not possess itself of the works, which would certainly have fallen a sacrifice to it. The same is true for the Roman buildings in north Africa, whose preservation we owe to the uncultured nomadic tribes, that became the possessors of the country instead of the Romans.

554. Tombs of the Jews near Jerusalem.

d. A similar course is shown by the Jewish tombs (shove graves) near Jerusalem. Since this people already employed foreign workmen for the building of their temples, so were foreign artists indeed likewise busied with the tombs of their great men, if those under consideration may be so taken in general. The question may remain here without discussion, but in no case are these the products of Jewish architects. That all figure ornament has vanished would at most accord with the Jews as employers.

The architecture is mixed in both technical respects and in forms. The monuments are not entirely hewn in the rock, as in Petra; it is only used so far as its extent sufficed. Every projection above the surface of the rocky plateau is constructed of ashlars and built up. As far as the Egyptian cavetto of the main cornice of the so-called Tomb of Absalom (Fig. 830) is the solid rock utilized, even to the extreme. Where anything might be gained, it is built in, as shown by certain places in the attic (Fig. 831). Attic, cylinder and cone are hollow constructions of dressed ashlars. According to these evidences, the upper part of the so-called Tomb of Absalom is not a later addition, but in accordance with the beginnings on the attic, it was so originally intended.(Fig. 783).

Pure works of sculpture, i.e., entirely cut in the rock, are the adjacent Tombs of James and of Zachariah (Figs. 832, 834). These three principal monuments, to which are further to be added the Tombs of the Kings and of the Judges, as well as finally the most interesting Tomb El-Messaneh, are the representatives of Greco-Jewish art, which reached its climax in the Palace of Hyrcanus (built about 180 B.C., according to Josephur). Hyrcanus ruled in these regions for 7 years under the reign of Seleucus (182 - 175 B.C.), and his building forms an assured basis (according to De Vogue) for the dating and study of the monuments of Jewish art mentioned. The style of the ornaments is Grecian, but not in perfected form; all profiles are of secondary style and do not belong to primitive Grecian art, like the mixture of the orders on the monuments. Columns with Corinthian or Ionic capitals, above which is a Doric triglyph frieze and Egyptian cavetto, are things belonging to early Roman art (Etruscan-Roman terra cottas, Sarcophagus of Scipio Barbatus, Triumphal Arch of Augustus in Aosta, and Temple of Augustus on Philae). The imitation ashlars between the antes of the Tomb El-Messaneh, the rosettes between the triglyphs, are characteristics of the Etruscan-Roman and Greco-Roman period (Sarcophaguses in Florence, architecture in Pompeii). Similarly the Jewish art of the time of Herod bears the stamp of the Augustan century with a remainder of oriental influence and a plant ornamentation of peculiar style. Thus for example, the tympanum of the Tomb of the Judges is specifically Jewish. The Grecian influence of the Seleucides on the Jews must be considered as proved, and the period of Jewish art in question comprises the time from Alexander the Great until after Augustus. In technical respects, the starting point therein is always "monolithism", which was ever cherished by Syrians and Phoenicians, and from which in the countries mentioned, even the Roman practitioner of that period could not always free himself.

De Saulcy [654] states on the contrary, that according to the assumptions of "archaeological investigations", the tombs belonged to the period of decadence, and that the date of their origin should be referred to the end of the 4 th century. He hemself only recognizes in them a rudeness of execution, but

cannot regard them as examples of the decadence of classic art. He places their origin in the 4 th century B.C.

Note 654. In Jerusalem. 32. Tombeaux dits d'Absalom et de Josaphat. Paris. 1882.

De Vogue prefers [655] for at least the Tomb of James the time shortly before or after the birth of Christ, while Perrot and Chipiez [656] assume a later date on account of their marks of Grecian art:-- "What prevents the attributing of a higher antiquity to these tombs, like De Saulcy, is that in all may be recognized at the first view elements bearing the stamp of Grecian art."

Note 655. In Le Temple de Jerusalem. Paris. 1864.

Note 656. In Histoire de l'Art dans l'Antiquite. Vol. 4. Paris. 1887.

De Saulcy states in his work mentioned below, [657] that the tombs (compare the general view of the three tombs in the Valley of Jehoshaphat in Fig. 832) are frequently described and represented by illustrations --"but always without sufficient accuracy." He exhibits his drawings and accompanies them with a corresponding text. Perrot and Chipiez reproduce them without criticism in their work mentioned in Note 656. I give my sketches of the year 1894 in Figs. 834 to 836, and I remark on the plates of De Saulcy:-- his plate 37 shows the cylindrical druc to be constructed of two courses of nearly equal height, which does not correspond to the reality. The attic superstructure above the Egyptian cavetto shows a smooth base course below the vertical slabs, a plain plinth, which does not exist. The base of the building is concealed. At my visit, the bases of the antes, 5.9 ins. high, were at least visible (Fig. 833); the ante capitals project between the half columns and cast a shadow on the latter, which again is not correct. Plate 38 shows the attic at a great scale with a projecting low base, which is likewise incorrect. The profiles approximately accord with the execution; yet the base of the cylindrical superstructure is omitted. On plate 39, on which is represented the Tomb of James, the details are lacking, while the general arrangement is faultless. On the Tomb of Zachariah on plate 40, the frieze without triglyphs is correct; the capitals of the antes and columns are on the contrary incorrect; the pilaster capital is given also as if

projecting above the capital of the column, which is not right. On place 41, the comparison of the magnitudes of the Tombs of Absalom and Zachariah, it is striking that the latter is drawn only half as large as the former. The defects of the large drawing reappear here, as well as the faulty statement concerning what is made in the solid rock, and what is constructed artificially. On the whole, no objection is to be made to the section.

Note 657. In Voyage autour de la Mer Morte et dans les Terres Bibliques execute de Dec. 1850 a Avril 1851. Vol. 2. p. 288. Tombeaux de la Vallee de Josaphat, Tombeau d'Absalom. Paris. 1853.

Note 658. De Saulcy. Plates 37 - 41.

The side of Tomb of Absalom is given in the text at 20.7 ft.; De Saulcy speaks of Ionic columns and half columns at the antes, while merely half and quarter columns occur at each side. "As far as the upper part of the cornice, the monument is monolithic. It is composed of assembled blocks above that." --, which so far is not quite correct, since above the Egyptian cavetto, parts of the superstructure are cut in the rock. For the Tomb of Zachariah, he gives the side as 18.2 ft.; what he there says concerning the columns and half columns is just as incorrect as the statements relating to the Tomb of Absalom. The external surfaces must have been covered with a very thin read coating ("very smooth roughcast"), where it is said, that the purely Ionic capitals are of greater elegance, and which may agree with my drawings in Fig. 834.

If earlier investigators, as for example Sepp,[659] paid more attention to the architectural details of the tombs and had not been so strongly attached to problematic indications, sounder results would have been obtained for the date of the origin of the tombs. A comparative examination of these monuments of Greco-Jewish art with others near them assigns no archaic period for the date of their construction, nor the decaying era of Constantine, which is particularly true for the Tomb of James, that shows pure Doric forms, but which has nothing to do with the early forms, but it rather recalls those of the Temple of Nemea or the Doric Temple at Myus in Asia Minor.[660]

Note 659. In Jerusalem und das heilige Land. Pilgerbuch nach Palästina, Syrien und Aegypten. Vol. 1. Schaffhausen. 1863.

Note 660. Also compare Flavius Josephus. Jüdische Altertümer. 3 rd edition. Translated by F. Kaulen. Cologne. Preface. Book 77. Bonn. 1892. Also English translation of his Antiquities).

555. Roman Tombs in Zehntland (Provinces).

e. Concerning the Roman tombs in the provinces (Zehntland), the Neumagen finds exhibited in the Provincial Museum in Treves afford abundant conclusions, together with those of the city and the government province of Treves, and further those in the Roman-Germanic Mentz, and at other places. They chiefly consist of detached structures, which in contrast to those in Palestine were richly covered with painted ornaments and figures. Not many finely executed works are to be found, in spite of the imperial capital of Treves. But still the finds remain grand representatives of the Gallo-Belgian type, on which are shown the ancient people of the Moselle in their costumes and in their acts in a vivid and lifelike manner.

Their origin is chiefly to be placed in the period from 100 to 250 A.D. The material employed for the Neumagen examples in particular consists of Jura limestone and sandstone, for the execution of which masters and workmen were indeed obtained from Treves. The limestone monuments exhibit the strong style and a richer ornamentation, the latter being indeed on account of the possibility of the easier and finer working of the material in comparison with the sandstone. The earlier memorials were constructed of stone slabs, the tombstones of the poor people being semicircular cylinders (battlement stones ?). The wealthier people preferred the tower-like structure, similar to that preserved in the Igel Pillar (Fig. 837). With its recurved top and its terminal Corinthian-like capital with the artichoke placed thereon (Fig. 838), we find it on the tombs of the era of Nero in Aquileia and again similarly in Petra, as well as in the valley of Jehoshaphat. Likewise in Regensburg are the remains of such works proved. The influence of Asia Minor and Greece through Marseilles, Löschke causes to affect these monuments; others only accept the influence of Asia Minor, but not "by way of Marseilles."

The monuments at Neumagen are first colored white; flesh and garments of the figures are yellow and rise from a blue or bluish-green ground; the outlines were executed in reddish=

brown; only the pilasters and cornices are in richer colors, for on them occur red and green besides yellow.[661]

Note 661. Compare Hettner, F. Illustrirter Führer durch das Provinzialmuseum zu Trier. p. 3. Treves. 1903.

Very notable in this respect is a tympanum 15.8 ft. long with the representation of a family meal, where the ground is painted blue, the ornaments being yellow, green and red. A beautiful example of a Tomb of Jura limestone, placed about 100 A.D., 6.35 ft. high and 2.95 ft. deep is given by Fig. 839, constructed for Caius Albinius Asper and his wife Secundia Restituta.

For the treatment of the acanthus in this period are presented assured data by a Tomb, on which are represented a teacher and his pupils.(Fig. 840).

For the city of Treves it should not be forgotten, that in 258 A.D., it was raised to become a Gallic capital, that under Diocletian (273) it again became a Roman capital, and that from 367 to 388, an emperor or a crown prince remained almost always permanently within its walls, and that from this time only date the great buildings, such as the imperial Palace, the Basilica and the Baths, as well as the precious marble sculptures. The city was lost to the Franks in 470; their cemeteries extended from the city limits along the roads. In the early imperial period, the dead were likewise burned in Treves, and their remains were deposited in clay or glass urns, or even in leaden boxes for ashes, while later burial predominated and became general about the middle of the 3 rd century. Only slight remains of the great tombs along the roads are preserved to us.

With the acceptance of the mode of burial, according to Hettner, the new form of sepulchral chamber originated, above which was arranged a superstructure like a chapel. For the tombs of soldiers, the form common on the Rhine, and which was traced to Aquileia, was likewise in use on the Moselle; the stone slabs with pediment top and acroterias.

556. Tombs in Gaul.

f. For the Gallic tombs, the Museums in Lyons, Nimes, Arles, etc., afford abundant data. The most important one still standing in place is that of Juliers near S. Remy (Fig. 843),

[illegible]

and [illegible] according to their necessities, the [illegible] [illegible], the general outlines of the [illegible] are still [illegible]. In [illegible] the [illegible] [illegible] a [illegible] [illegible] [illegible] placed above each other, and [illegible] [illegible] [illegible]. It [illegible] [illegible] an [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] a [illegible] [illegible] [illegible] [illegible] capital and [illegible] [illegible] of [illegible] [illegible]. [illegible] [illegible] be [illegible] with the [illegible] [illegible] [illegible] [illegible] [illegible] of [illegible], [illegible] [illegible] [illegible], [illegible] [illegible] of [illegible] a [illegible] degree of [illegible] [illegible].

[illegible]. [illegible] in Picardie and [illegible].

[illegible]. [illegible] [illegible] of Picardie and [illegible], [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible], [illegible] [illegible] [illegible] [illegible] [illegible] [illegible], [illegible] [illegible] [illegible] [illegible], which could not be used for [illegible]. [illegible] of the [illegible] [illegible] [illegible] in the [illegible] century [illegible]. [illegible] [illegible] [illegible] [illegible] of the [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible], and the [illegible] [illegible] [illegible] [illegible]. But [illegible] the [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] of [illegible] [illegible], [illegible] [illegible] [illegible] [illegible] of [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] and [illegible] [illegible] [illegible] [illegible] [illegible]. [illegible] [illegible] [illegible] [illegible] [illegible] [illegible], [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible], [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible], [illegible] [illegible] [illegible] [illegible] [illegible], [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]. [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible], [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible], [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]. A [illegible] of a [illegible] [illegible] is [illegible] by [illegible] [illegible].

[illegible]

[illegible]

[illegible]

[illegible]

willingly brought into connection with the Igel column. Much good will appertains to this assumption, for architecturally considered, the ground motives of the two are still very different. In S. Remy is the ancient Roman recipe; a cube, cylinder and cone placed above each other, the cub and cylinder being perforated. In Igel occurs an entirely closed tall prism with four pediments and a stone bulbous roof supporting a Corinthian capital and an eagle on that place. Rather might it be compared with the Ephesian trophy or with the circular structure of Temenos, adorned by columns, in both of which is a nearer degree of relationship.

557. Tombs in Pisidia and Pamphylia.

g. In the cities of Pisidia and Pamphylia, men desired to not take away the soil from the living, therefore placing the tombs on rocks, heights and on steep slopes, which could not be used for cultivation. Most of the remaining tombs belong to the 2 nd century A.D. Burial and the enclosure of the dead in stone sarcophaguses had here won predominance over cremation, and the monuments are shaped accordingly. But beside the modest stone coffins there occur lavish ornamented buildings for the disposal of the dead, that are either made of coursed ashlars or cut from the solid rock and quite richly ornamented by sculptures. We find here the grotto tomb, the steles wrought in relief, sarcuphaguses with pilasters and half columns, covered by a lid like a tiled roof, or after the Etruscan fashion with one formed like a cushion, on which lay a married pair, or as in Lycia, the house shaped tomb with entrance like a doorway. The little temple with the sarcophagus placed therein is also found' then the small temple with ostothek (little house within a house), the temple with the double sarcophagus, the arcosolium with coffin and stele, the vaulted tomb with sarcophagus, the house tomb with or without a vestibule adorned by columns, within whose interior stood one or more sarcophaguses.[662] A view[663] of a rich Tomb is given by Fig. 841.

Note 662. Reproduced from Niemann.

Note 663. See Lanckoronski, C. Die Städte Pamphyliens und Pisidiens. Vienna. 1890.

h. Men proceeded more economically for the ground and soil

[illegible] and at Rakkah in Syria by the [illegible]

[illegible] (Fig. [illegible] of [illegible], [illegible]

[illegible]

[illegible] forms [illegible]

[illegible] small [illegible]

[illegible] only the [illegible] The most [illegible]

[illegible] to a [illegible] of [illegible]

[illegible] and 1111 [illegible]

[illegible] of [illegible]

[illegible]

[illegible] The [illegible] quantity was [illegible] for [illegible] and was

[illegible] in Syria [illegible]

Note [illegible]. [illegible] from 19 [illegible].

Note [illegible]. [illegible] Vol. I.

[illegible]

5. A [illegible] was [illegible]

[illegible]

[illegible]

[illegible] which [illegible]

[illegible] The [illegible] of [illegible]

[illegible]

[illegible] the same of [illegible]

[illegible]

[illegible] plan and view [illegible] Fig. [illegible]

[illegible] The [illegible] of a [illegible] was [illegible]

[illegible] in the [illegible]. It [illegible]

[illegible] of [illegible] found in

[illegible] and [illegible]

[illegible]

[illegible] of [illegible]

at Palmyra and at Baalbec in Syria by the arrangement of sepulchral temples (Fig. 842) and of tower tombs, corresponding to the limited sites. Rock-cut tombs were excluded by the basalt-like hardness of the stone there. Whatever tombs were otherwise executed had the form of small temples. Most have disappeared and only the tower tombs remain. The most beautiful belonged to a family of Bassus in Chagga; others are to be found in Kennawat and Atil. Nearly all data is from the 2 nd century of our era. Most characteristic is that of Jamlichus in Palmyra, built in 83 A.D., which Fig. 844 [664] gives in plan, elevation and section. It has five stories, separated by the floors of slabs and connected together by stone stairways. The lower story is richly ornamented by pilasters, frieze, coffered ceiling and figures, and it was painted to correspond. three deep niches in the masonry were subdivided into a number of shelf graves (loculi) by slabs, each intended to receive a corpse. The second story was intended for the family and was richly treated; the upper ones , on the contrary, were made simple and were designed to receive relatives, frredmen and slaves. The exterior is simple, but elegant.[665]

Note 664. Reproduced from De Vogue.

Note 665. Compare De Vogue. Vol. 1.

558. Columbariums.

i. A still smaller area of ground was required by the columbariums with a greater possible capacity, on account of the similarity of their arrangement to the dovecots of the same name. They were great vaulted rooms, whose external and division walls were entirely covered by small semicircular niches for the receptisn of urns for ashes. The number of these niches frequently amounted to several hundred. Each of them was intended for two urns, which contained the ashes of the dead. A lid closed the vessel for ashes. The name of the person deposited therein was sometimes written on the surface of the wall below the niche (Compare plan and view in Figs. 845, 846). The illustration of a richly treated urn, which was intended to be seen and not inserted in the masonry, is given by Fig. 847. Other sple ndid examples of urns are found in the Museums at Florence, Rome and Naples, especially beautiful examples being in the Museum Lateran, so rich in architectural objects, and in the Hall of the Candelabra of the Vatican.

559. Catacombs.

k. With burial places sparing the ground for use, but which made no attempt at architectural development, are to be counted the catacombs, as subterranean cemeteries of religious communities, where the associated believers remained together after death, according to their principles. They date from an ancient time and extend down to the first Christian centuries.

560. Tombs of the Emperors.

1. In Rome occurred the same procedure as in the provinces mentioned. Burial or cremation of the dead also here prescribed the form of the tomb. Burial outside the city and along the great military roads was also the rule in Rome. Small memorials and rich monuments alternated together, each according to the means of the families. For the poor sufficed some tiles placed together as a last enclosure (Fig. 818). Others had to be satisfied with a stone slab, a small temple, a sarcophagus, an altar stone, and the like. Nothing new or specifically characteristic of the city of Rome is to be found.

Only the great and the greatest of the empire recalled the monumental memorials, which previous rulers had caused to be erected in memory of their persons and their deeds, designed to make known their fame to still later races. They would not remain indebted to their predecessors. Wat an Alyattes, a Porsenna, or a Mausolus, or the Egyptian dynasties could do for themselves, should this be refused to the much greater Roman emperors?

561. Mausoleum of Augustus.

With great expenditure, Augustus first erected his mausoleum on the Campus Martius in 28 B. C. He constructed a cylindrical substructure 311. ft. in diameter, whose wall surfaces were subdivided by deep niches covered by half domes; this enclosed the relatively small sepulchral chambers, access to which was afforded by a vestibule adorned by columns. Above the stone structure was heaped a vast hill of earth planted with cypresses, on the apex of which stood the colossal statue of the emperor.

562. Mausoleum of Hadrian.

Even more grandly than the former imperial tomb rose the Mausoleum of Hadrian (Moles Hadriani), the modern Castle of

S. Angelo, on the bank of the Tiber with its mighty substructure 275 ft. square and a drum 210 ft. in diameter. The Tomb was completed by Antoninus Pius in 139 A.D. and was built by Hadrian for himself and his successors, all the emperors until Caracalla (217 A.D.) being buried there with him. It was indeed constructed in accordance with the ancient rule, consisting of the square substructure, the cylindrical intermediate story and the conical top, with the statue of the emperor on its apex. The form of the substructure is proved by various architectural finds and by the measured sketches of Sangallo and of Sansovino, even more by the drawings preserved in the Escurial, which Hülsen published in his Jahresberichte (Annual Report) on the Topography of the City of Rome.(Compare Fig. 848 [666] and the scale drawing in Fig. 849 [666] derived therefrom). But with this ends our knowledge of the appearance of the building at first. [667]).

Note 666. Reproduced from Hülsen, Ch. Jahresbericht über neue Funde und Forschungen zur Topographie der Stadt Rom.

Note 667. Compare Borgatti, M. Castel Sant' Angelo in Roma. Rome. 1890.

Borgatti has proved by investigations, that above the square base was built only a single cylindrical principal story containing the sepulchral chamber, and that this was crowned by a high base with a colossal statue (quadriga ?). Thereby was overthrown the previously and commonly prevailing assumption, that above the existing cylindrical structure rose a second similar one of somewhat smaller diameter; for this contradicts the actual report, -- but which it no longer gives! A passage of Procopius quoted for the previous assumption, that the Tomb exceeded the city wall in height, is no reason for regarding this excess as established. It is indeed merely stated with reference to the effect in the view of the city, which may have varied much according to the stand point of the observer. The actual dimensions of the two are not given. The funeral pile (rogus), as represented on the dedicatory coin remains indeed as a model of the monument (Fig. 850). It consists of the substructure adorned by garlands of leaves, above which are erected stories diminishing in elevation -- ornamented by columns and figures, above which and on a base hung with fabrics stands the emperor in the quadriga. It is a structure,

[illegible] columns. [illegible] at least [illegible] of the roof [illegible]

[illegible] he could see nothing whatever of the entire in- [illegible]. The cylindrical structure is one story [illegible] only exist, if a high conical roof covered it and if [illegible] or [illegible] dome [illegible] conceived [illegible]

[illegible]

[illegible] the city. A small [illegible]

[illegible]

which is harmoniously developed and shows good outlines, while this cannot be determined from the illustration (Fig. 851) given from Hülsen's Jahresbericht. According to the stand point of the observer, he does not see at all the quadriga from the substructure decorated by columns. One must recede from it more than twice as far as the entire height of the monument, if he wished to enjoy a view of at least two-thirds of the cap, which rose from the invisible surface of the roof without any visible connection. But if one walked about 328 ft. towards the monument, he would see nothing whatever of the entire imperial magnificence. The cylindrical structure in one story could only exist, if a high conical roof crowned it according to the traditional manner, on whose truncated top would be placed the quadriga. What Borgatti proposed is not conceived with taste nor like Roman, and what is presented in opposition is not good. The Goths (537 A.D.) must already have fortified the terrace of the substructure, and the statues of the attic of the strongly receding cylindrical building would have been dangerous to them. But were not originally the projecting angles of the substructure 42.6 ft. in height already occupied by groups of figures?

From the entrance to the bridge on the left bank of the Tiber to the monument is about 394 ft.; it is a stone's throw distant from the right bank. The city wall near Gate Flaminia lies about 4260 ft. from the Castle of S. Angelo; a traveller on Via Flaminia, standing about 3280 ft. from the Gate, sees the city over the Wall of Aurelian; he would observe no more than the pedestal of the quadriga, but nothing whatever of the monument itself -- and this would be the best view point conceivable outside the city. A stand point on a hill cannot be harmonized with the statement of Procopius. But does one generally view art works from a distance of 1.56 miles, especially if scarcely more than the half can be seen from thence? Fig. 852 exhibits a correction of the suggestion made by Hülsen and Schultze, retaining the cylindrical elevation in a single story "discovered" by Borgatti. Just by reason of the great dimensions do I hold that a subdivision of the wall surfaces by piers or strongly projecting pilasters, as for the lower stories of the Amphitheatres at Nimes

and Arles, to be more suitable and more correct in style, than such a treatment with entire or half columns. Might not the Trophy of Trajan (Tropaeum Trajani) at Adamklissi be instructive for influencing every attempt to restore the Mausoleum (Moles) of Hadrian? How much has the representation of the former been inspired by the insertion of the elevated base of the trophy of arms, discovered by Furtwängler? [668]

Note 668. The sight lines from the right and left banks of the Tiber are drawn in Fig. 852, which absolutely require a high conical roof, if another story as a substructure for the statue of the emperor must be omitted. The angles of the Substructure are cut off and have a recurrence of the vertical subdivision, better attained by trophies than by Borgatti's horse-tamers. For the conical roof may be assumed a covering like that of the Monument in Adamklissi, like the one of the circular temple represented with concave and flat tiles, or similar to the conical roof on the Tomb of Juliers near S. Remy.(Fig. 852).

563. Tomb of Cecilia Metella.

A slight attempt at imitation of the ancient tumulus, but still beautiful in detail and dating from the period of the republic, is the Tomb of Cecilia Metella on Via Appia near Rome, also the Tower-Tomb of the Plautii at Porte Lucano below Tivoli. Above a square base rises the cylindrical structure, which terminates with a splendidly wrought frieze decorated by ox-skulls, and it formerly supported a roof of conical form with a figure at the apex.

564. Tombs in the Form of Temples.

After the 2 nd century occur tombs in temple form. Domitian built on the Quirinal the Tomb of the Flavian family, where the cell served as a chapel or memorial hall, the substructure as the sepulchral apartment for receiving the sarcophaguses and urns; inscriptions and statues ornamented the exterior. Fig. 853 gives a representation of the Roman tomb in the form of a temple; on a high substructure rises a square cell with a portico of 4 columns. The cell and crypt are vaulted. The latter received the dead, the former served as an assembly hall for the relatives on the occasion of burials and memorial services. Corresponding to this purpose, the walls and ceilings are dec-

decorated in the richest manner by stucco and paintings, an example of which is given by Fig. 854. Polygonal and circular plans for tombs were preferred to the square and rectangular temple cells, i.e., the central plan here secured the supremacy. The architectural remains near Tivoli, the so-called Temple della Tosse, and those at Torre dei Schiavi outside Rome afford evidence of this.

565. Mausoleum of Diocletian at Spalato.

In Figs. 855 and 856 [689] is represented such a round building with a rectangular portico, similar to the design of the Pantheon after a restoration by Isabelle. More nobly is the architectural idea expressed at the Mausoleum of Diocletian at Spalato, to whose construction and details reference was previously made in Art. 215. We likewise here find the vaulted substructure, that served to receive the sarcophagus, over it being the chapel, richly ornamented by columns and sculptures (Fig. 857, section; Fig. 858, plan; Fig. 859, a portion of the external portico), which was externally surrounded by a portico extending in octagonal form and covered by a terrace roof. The costly material -- white Istrian limestone, red and gray granite -- is visible both inside and outside, only the surface of the dome in the interior being arranged for a covering, which either consisted of stucco and painting, or more probably of mosaics.

566. Tomb of S. Costanza near Rome.

The most important and still completely preserved example of a sepulchral tomb in circular form is exhibited by the present Church of S. Costanza near Rome. As shown by the plan (Fig. 860), the interior consists of an elevated domed structure resting on columns, enclosed by a low side aisle covered by an annular vault, which is externally surrounded by a portico, a long vestibule being arranged before the entrance. Erected by Constantine as the Tomb of his daughter Constantia, it is the only building, except the Baptistery at Nocera, which is based on approximately a similar structural idea, wherefore it is proposed to assume the same architects for both -- an assumption, in brief, in which I cannot concur. The details and construction of the building in Nocera have not been thoroughly examined and tested. Of great interest in S. Costanza are the yet well

preserved mosaics from the 4 th century (Fig. 861). Desgodetz gives in his works [670] a good description of the building, that he designates as a Temple of Bacchus, "since a vintage occurs in the mosaics." He then complains again concerning the inaccuracies of the drawings of the building by Palladio and Serlio. He says of the latter, that all his statements of dimensions are so disproportionate, that none of them are correct.

567. Sarcophaguses.

Besides the ancient mosaics is still to be mentioned the porphyry sarcophagus of S. Costanza, found here and now exhibited in the Vatican, and with this that of S. Helena, the mother of Constantine, likewise in the Vatican. Of red porphyry and adorned by reliefs of captured barbarians and of mounted Romans, ornamented with garlands and cupids on the lid, this splendid work in material and execution, but not what artistic conception demands, was found in the octagonal building (Torre Pignatura, the Tomb of S. Helena; Fig. 862).

Both objects require comparison with similar works from the time of the republic -- to the Sarcophagus of Scipio Barbatus of worthless and easily wrought peperino (Fig. 863) -- and to a Sarcophagus constructed of white marble, rich in figures and from the best Roman imperial period (Fig. 864).

Where is here the higher art? Certainly not in works of the time of Constantine, striking on account of the toilsome labor, magnitude, and the costly material! The comparison of three works for the same purpose, from the beginning, the climax and the end of a world empire tells the story as well as an entire volume.

The eagle within a garland of oak leaves, the symbol of civic Roman magnificence, confirms what is said in praise and in explanation of the Roman world architecture. the instruction to be derived therefrom will authorize in future the German eagle in its flight throughiut the world, crowned with oak leaves -- to the eagle of the holy Roman empire, the German nation with the oaken garland of the civic crown. We will return the instruction!

Note 671. Compare Matz, F. and F. von Duhn. Antike Bildwerke in Rom, etc. Leipzig. 1881-1882.

BIBLIOGRAPHY.

Books on the"Architecture of the Romans."

Vitruvius. De Architectura. -- German translation by F. Reber; Des Vitruvius zehn Bücher über Architektur. Translated and explained by Notes and Sketches. Stuttgart. 1865.

Desgodetz, A. Les Edifices Antiques de Rome etc. Paris. 1682, 1693 and 1779.

Piranesi, G. Le Antichita Romane. Rome. 1756.

Cassas. Voyage pittoresque et historique de l'Istrie et de la Dalmatie etc. Paris. 1802.

Valadier, G. Raccolta delle piu insigni Fabriche di Roma antica etc. Rome. 1810 - 1820.

Mazois, F. Les Ruines de Pompeii. Paris. 1824 - 1838.

Zahn, W. Die schönsten Ornamente und merkwürdigsten Gemälde aus Pompeii, Herkulaneum und Stabiae, etc. Berlin 1828 - 45.

Rossini, L. Le Antichita Romane ossia raccolta delle interessanti Vedute di Roma. Rome. 1829.

Plattner, E, C. Bunsen, E. Gerhard & W. Borstell. Becshreibung der Stadt Rom. Stuttgart & Tübingen. 1829 - 37.

Burckhardt, J. Der Cicerone etc. Leipzig. 1835. 7 th edit. edited by W. Bode. 1898.

Donaldson, Th. L. Collection des exemples les plus estimes des portes monumentales de la Grece et de l'Italie. Published by Thiollet. Paris. 1837.

Texier, Ch. Description de l'Asie Mineure faite par ordre du gouvernement francais de 1833 a 1837 etc. Paris. 1839-49.

Ternite, W. Wandgemälde aus Pompeji und Herculanum etc. With explanatory text by C. O. Müller. Berlin. 1839-58.

Canina, L. Gli Edifici di Roma. Rome. 1849 - 1852.

Overbeck, J. Pompeji in seine Gebäuden , Alterthümern und Kunstwerken. Leipzig. 1856. -- 1 th edit. edeted by A. Mau. 1884.

Rich, A. Illustrirtes Wörterbuch der römischer Alterthümer etc. Translated from the English by C. Müller. Paris. 1862.

Reber, F. Die Ruinen Roms und der Campagna. Leipzig. 1863. -- 2 nd edition. 1878.

Vogüe, M. de. L'Architecture civile et religieuse en Syrie du Ier au VIIe Siecle dans la Syrie centrale. Paris. 1866-77.

Burton, R. & Ch. Drake. Unexplored Syria. London. 1872.

Choisy, A. L'Art de Batir chez les Romains. Paris. 1873. New edition. 1876.

Luynes, De. Voyage d'Exploration a la Mer Morte, a Petra et sur la rive gauche du Jourdain. Edit. de Vogue. Paris. 1874.

Leger, A. Les Travaux publics, les mines et la metallurgie aux temps des Romains etc. Paris. 1875.

Marquardt, J. & Th. Mommsen. Handbuch der rōmischen Alterthūmer. Leipzig. 1875 - 78.

Baedeker, K. Palāstina und Syrien. Von A. Socin. Leipzig. 1875. -- 5 th edition. 1900.

Blūmner, H. Technologie und Terminologie der Gewerbe und Künste bei Griechen und Rōmern. Leipzig. 1875 - 84.

Schōner, R. Pompeji. Beschreibung der Stadt. Stuttgart. 1876.

Guhl, E. & W. Koner. Das Leben der Griechen und Rōmer nach antiken Bildwerken dargestellt. Berlin. 1876.

Desjardins, E. Geographie historique et administrative de la Gaule Romaine. Paris. 1876 - 85.

Nissen, H. Pompejanische Studien zur Stādtekunde des Alterthums. Leipzig. 1877.

Parker, J. G. The architectural history of the city of Rome. London. 1881.

Daremberg, Ch. & E. Saglio. Dictionnaire des antiquites Grecques et Romaines. Paris. 1887 et seq.

Kekule, R. Die antiken Terracotten. Vol. 1. Abt. 1, 2; Die Terracotten von Pompeji. by H. von Rohden. Stuttgart. 1880.

Bender, H. Rom und rōmisches Leben im Alterthum. Tūbingen. 1880.

Būhlmann, J. Die Architektur des klassischen Alterthums und der Renaissance. Stuttgart. 1886 - 87. -- 3 rd edit. 1902.

Uggeri, A. Giornale pittoreschi degli edefizi di Roma et dei contorni. Rome. 1880. French translation; Journees pittoresques des edifices de Rome ancienne. By H. d'Auribeau. Rome. 1880.

Mau, A. Geschichte der decorativen Wandmalerei in Pompeji. Berlin. 1882.

Naeher, J. Die baulichen Anlagen der Rōmer im Zehntland (badischen Antheils). Carlsruhe. 1883.

Hauser, A. Spalato und die rōmischen Monument Dalmatiens etc. Vienna. 1883.

Jordan, H. Topographie der Stadt Rom. Berlin. 1884.

Martha, M. Archaeologie Etrusque et Romaine. Paris. 1884.

Antike Baudenkmäler. Herausgegeben von kais. Deutsch Arch. Inst. Vols. 1, 2. Berlin. 1886 - 1901. (Incomplete).

Collection de M. le Vicomte de Ponton d'Amecourt. Catalogue de monnaies d'or Romaines et Byzantines. Paris. 1887.

Baumeister, A. Denkmäler des klassischen Alterthums. Munich & Leipzig. 1888.

Friedländer, L. Darstellungen aus der Sittengeschichte Roms in der Zeit von Augustus bis zum Ausgange der Antonine. Leipzig. 1864. -- 6 th édition. 1889.

Lanckoronski, C., G. Niemann & E. Petersen. Städte Pamphyliens und Pisidiens. Vienna. 1890.

Mau, A. Führer durch Pompeji. Leipzig. 1896.

Schneider, A. Das alte Rom. Development of its plan and the history of its buildings. Leipzig. 1896.

Kiepert, H. & Ch. Hülsen. Formae urbis Romae antiquae, accedit nomenclator topographicus. Berlin. 1896.

Gauckler, P. L'Archaeologie de la Tunisie. Paris & Nancy. 1896.

Lanciani, R. The ruins and Excavations of ancient Rome. Boston & New York. 1897.

Cagnat & Gauckler. Les monuments historiques de la Tunisie. Part 1, Vol. 1: Les temples paiens. Paris. 1898.

Schulten, A. Das römische Afrika. Leipzig. 1899.

Merckel, C. Die Ingenieurtechnik im Altertum. Berlin. 1899.

Choisy, A. L'histoire de l'architecture. Vol. 1. Paris. 1899. XII. p. 512 - 612: Architecture Romaine.

Petersen, E. Berühmte Kunststättin. No. 1. Vom alten Rom. Leipzig. 1900.

Mau, A. Pompeji in Leben und Kunst. Leipzig. 1900.

Gsell, St. Les monuments antiques de l(Algerie. Paris. 1901.

Diehl, Ch. En Mediterrannee. Paris. 1901.

Borrmann, R. & J. Neuwirth. Die Baukunst des Altertums. Leipzig. 1904.

Marriott, F. Facts about Pompeii, its masons' marks, town, walls, houses, and portraits. London. (No date).

Lanciani, R. New Tales of old Rome. London. (No date).

Tremaux, P. Exploration archaeologique en Asie mineure. Paris. (No date).

Mittheilungen des kaiserliche deutschen archaeologischen Instituts. Römische Abteilung. Rome. Has appeared since 1886.

Jahrbuch des kaiserliche deutschen archaeologischen Instituts. Edited by Conze. Berlin. Has appeared since 1882.

Sonderschriften des Oesterreichischen archaeologischen Instituts in Wien. Issued since 1901.

Schriften der Balkancommission. Published by the Kaiserliche Akademie der Wissenschaften. Antiquarische Abteilung. Vienna. Has appeared since 1900.

Bulletino della commissione archaeologica comunale di Roma. Has appeared since 1892.

Bulletino dell' Istituto di correspondenza archaeologica. Rome. Has appeared since 1829.

Annali dell' Istituto di correspondenza archaeologica. Rome. Has appeared since 1829. -- Also Supplementi.

Notizie degli scavi di antichita. Publicate per cura della Reale Accademia dei Lincei. Rome. Has appeared since 1826.

Monumenti antichi. publicate per cura della Reale Accademia dei Lincei. Rome. Has appeared since 1889.

Monumenti dell' Istituto di correspondenza archaeologica. Rome. Has appeared since 1829.

- - - - -